



HARVARD UNIVERSITY



GEOLOGICAL SCIENCES
LIBRARY

17,616

June 11, 1902.

PEAKS, PASSES, AND GLACIERS.

SECOND SERIES.

VOL. II.

LONDON
PRINTED BY SPOTTISWOODE AND CO.
NEW-STREET SQUARE



THE EIGER JOCK, FROM THE WENGERN ALP.

PEAKS, PASSES, AND GLACIERS;

BEING

EXCURSIONS BY MEMBERS OF THE ALPINE CLUB.

SECOND SERIES.

EDITED BY

EDWARD SHIRLEY KENNEDY, M.A., F.R.G.S.

PRESIDENT OF THE CLUB.



*Vesci aurâ ætheræâ jucundum vertice montis,
Ardua respicere, et dextram conjungere dextræ.*

IN TWO VOLUMES—VOL. II.

LONDON:

LONGMAN, GREEN, LONGMAN, AND ROBERTS.

1862.

c

RARE
BTDK
ROOM

SPEC
DQ
823
A6
1862
V.2

CONTENTS

OF THE SECOND VOLUME.



CHAPTER VII.

THE BERNESE, VALAISIAN, AND URNER OBERLAND.

	PAGE
1. THE ASCENT OF THE SCHRECKHORN. By the Rev. Leslie Stephen, M.A.	3
2. THE PASSAGE OF THE EIGER JOCH. By the Rev. Leslie Stephen, M.A.	15
3. THE ASCENT OF THE ALETSCHEORN. By F. F. Tuckett, F.R.G.S.	34
4. FROM THE GRÜTLI TO THE GRIMSEL. By R. W. Elliot Forster	73

CHAPTER VIII.

THE PYRENEES.

By CHARLES PACKE, B.A.

THE PASSAGE OF THE PORT D'OÏ AND ASCENT OF THE PIC DES POSETS	101
---	-----

CHAPTER IX.

THE COTTIAN ALPS.

By WILLIAM MATHEWS, JUN., M.A.

1. EXPLORATIONS ROUND THE FOOT OF MONTE VISO	129
2. ASCENT OF MONTE VISO	147

CHAPTER X.EXCURSIONS IN DAUPHINÉ.

	<u>PAGE</u>
1. <u>INTRODUCTORY REMARKS</u>	181
2. <u>THE PASSAGE OF THE COL DE LA TEMPE, FROM THE VALLEY OF LA BÉRARDE TO THE VAL LOUISE, AND OF THE COL DE L'ÉCHAUDA, FROM VAL LOUISE TO LE MONÉTIER.</u> By R. C. Nichols, F.S.A.	183
3. <u>THE VAL DE ST. CHRISTOPHE AND THE COL DE SAIS.</u> By the Rev. T. G. Bonney, M.A., F.G.S.	198
4. <u>A SKETCH OF THE COL DE LA SELLE, FROM LA GRAVE TO ST. CHRISTOPHE.</u> By F. E. Blackstone, B.C.L., F.R.G.S.	215
5. <u>THE ASCENT OF MONT PELVOUX.</u> By Edward Whympre	223

CHAPTER XI.THE GRAIAN ALPS.

1. <u>THE HUNTING GROUNDS OF VICTOR EMMANUEL.</u> By F. F. Tuckett, F.R.G.S.	239
2. <u>A NIGHT BIVOUAC ON THE GRIVOLA.</u> By F. F. Tuckett, F.R.G.S.	292
3. <u>THE ASCENT OF THE GRIVOLA.</u> By John Ormsby	318
4. <u>THE ALPS OF THE TARENTEISE.</u> By W. Mathews, Jun., M.A.	339
5. <u>TWO ASCENTS OF THE GRAND PARADIS.</u> By J. J. Cowell, F.R.G.S.	408

CHAPTER XII.THE GLACIERS OF NORWAY.

<u>A VISIT TO THE JÖKULS GLACIER.</u> By John Frederick Hardy, B.D.	429
---	-----

CHAPTER XIII.PHENOMENA OBSERVED ON PEAKS, PASSES, AND GLACIERS.

1. <u>AMOUNT OF OZONE AT DIFFERENT ALTITUDES.</u> By F. F. Tuckett, F.R.G.S.	445
2. <u>THE DIRT-BANDS OF THE LOWER GRINDELWALD GLACIER.</u> By F. F. Tuckett, F.R.G.S.	455

CHAPTER XIV.HYSOMETRICAL SUGGESTIONS.

1. <u>HYSOMETRY AND THE ANEROID</u> By Rev. G. C. Hodgkinson, M.A.	463
2. <u>CONTRIBUTIONS TO ALPINE HYSOMETRY.</u> By F. F. Tuckett, F.R.G.S.	484

CHAPTER XV.TABLE OF THE HEIGHTS OF PEAKS AND PASSES.

1. <u>INTRODUCTORY REMARKS</u>	503
2. <u>TABLE OF ALPINE PEAKS</u> By F. F. Tuckett, F.R.G.S.	506
3. <u>TABLE OF ALPINE PASSES.</u> By F. F. Tuckett, F.R.G.S.	528
4. <u>TABLE OF PYRENEAN PEAKS AND PASSES.</u> By Charles Packe, Jun., B.A.	538

LIST OF ILLUSTRATIONS

IN THE SECOND VOLUME.

MAPS.

1. The Glaciers of the Oberland	<i>to face page</i>	3
2. The Alps of Uri	"	73
3. The Pyrenees, South of Luchon	"	101
4. Monte Viso and surrounding District	"	129
5. Sketch Map of Mont Pelvoux	"	181
6. The Graian Alps	"	259

WOODCUTS.

1. The Eiger Joch from the Wengern Alp, from a photograph	<i>Frontispiece.</i>	
2. The Schreckhorn from the Grindelwald Glacier, from a sketch by E. T. Coleman	<i>to face</i>	4
3. The Aletschhorn from the Eggischhorn, from photographs	<i>to face</i>	37
4. Summit of the Thierberg		90
5. The Triften Joch and the Rhone Glacier, from a photograph		96
6. The Port d'Oo, Pyrenees, from a sketch by C. Packe,	<i>to face</i>	106
7. The Pic de Sauvegarde and Port de Venasque, from a sketch by C. Packe		116
8. The Maladetta from the Antenac, from a sketch by C. Packe		122
9. Monte Viso from the N., from Taylor and Nodier and original sketches	<i>to face</i>	129
10. Diagram of Monte Viso and adjoining Mountain Ridges, by W. Mathews, jun.		132
11. Outline Sketch of the Viso from Turin, from a sketch by F. F. Tuckett		148
12. The Summit of Monte Viso, from a sketch by W. Mathews, jun.		157

	PAGE
13. A Pinnacle of Monte Viso, from a sketch by W. Mathews, jun.	167
14. Col de Sais and Glacier de Condamine, from a sketch by R. C. Nichols	180
15. Pinnacles of Mont Pelvoux, from the Glacier Noir, from a sketch by R. C. Nichols	183
16. Glaciers of the Valley of Aléfroide, from Taylor and Nodier	194
17. La Berarde, from Taylor and Nodier	to face 198
18. The Mountains of St. Christophe, from a sketch by Rev. T. G. Bonney	203
19. The Pic d'Aléfroide (Pic Sans Nom), from the Col de Sais, from a sketch by Rev. T. G. Bonney	209
20. Aiguille du Midi de la Grave, from a sketch by F. E. Blackstone	217
21. Sketch-Map of Author's Route, by F. E. Blackstone	221
22. Mont Pelvoux, from above La Bessée, from a sketch by E. Whymper	223
23. Outline by Elie de Beaumont	227
24. Cascade near La Grave, from a sketch by E. Whymper	232
25. Mont Pelvoux, from the Vallon d'Alfred, from a sketch by E. Whymper	236
26. Outline Sketch to show Author's route, by E. Whymper	247
27. A Buttress of Mont Pelvoux, from a sketch by E. Whymper	249
28. The Grivola from Col D'Arbole, from a sketch by F. F. Tuckett	268
29. The Grivola from below the Col de Nivolet, from a sketch by F. F. Tuckett	286
30. Summit of the Grivola, from a sketch by F. F. Tuckett	300
31. The Grivola from the South-west, from a sketch by F. F. Tuckett	to face 318
32. The Grivola from the East, from a sketch by John Ormsby	323
33. The Rutor from Aosta, from a drawing by George Barnard	383
34. The Grand Paradis from the Cramont, from a sketch by J. J. Cowell	411

PEAKS, PASSES, AND GLACIERS.

SECOND SERIES.

VOL. II.

CHAPTER VII.

THE BERNESE, VALAISIAN, AND URNER OBERLAND.

1. THE ASCENT OF THE SCHRECKHORN.
2. THE PASSAGE OF THE EIGER JOCH.
3. THE ASCENT OF THE ALETSCHHORN.
4. FROM THE GRÜTLI TO THE GRIMSEL.

1. ASCENT OF THE SCHRECKHORN.

BY THE REV. LESLIE STEPHEN, M.A.

EACH of the three best known glacier systems of the Alps is distinguished by characteristic beauties. The mighty dome of Mont Blanc, soaring high above the ranges of aiguilles, much as St. Paul's rises above the spires of the city churches, is perhaps the noblest of single mountain masses. The intricate labyrinths of ice and snow that spread westwards from the Monte Rosa, amongst the high peaks of the Pennine range, form the greatest stretch of continuous glacier in the Alps, whilst the unrivalled obelisk of the Matterhorn rises like a monument from their centre. But neither Chamounix nor Zermatt can, in my opinion, show such a variety of the noblest scenery as the Bernese Oberland. The stupendous fortress of mountains whose battlements overhang in mid air the villages of Lauterbrunnen and Grindelwald; the pasturages of the Scheideck and Wengern Alps; the broad streams of ice, many miles in length, that pour down the gentler southern slopes towards the valley of the Rhone; and the seven great summits that overlook unnumbered hills and plains throughout the whole of Switzerland, compose a mass of incomparable beauty and grandeur. Four of these summits, the Jungfrau, the Mönch, the Eiger, and the Wetterhorn, stand like watch-towers on the very edge of the cliffs. Of these the Jungfrau was first ascended by

some peasants in 1828; the Mönch*, by Dr. Porges, of Vienna, in 1857; the Eiger, by an English gentleman in 1858; and the Wetterhorn, by Mr. Wills in 1854. The three other summits stand in the very heart of the snow-fields. Of these the Finsteraarhorn was first scaled by Herr Solger, in 1841; and the Aletschhorn, by Mr. Tuckett, in 1859. The Schreckhorn still remained unconquered till 1861.

The Schreckhörner form a ridge of rocky peaks, forking into two ridges about its centre, the ground-plan of which may thus be compared to the letter Y. The foot of this Y represents the northern extremity, and is formed by the massive Mettenberg, whose broad faces of cliff divide the two glaciers at Grindelwald. Half-way along the stem rises the point called the Little Schreckhorn. The two chief summits rise close together at the point where the Y forks. The thicker of the two branches represents the black line of cliffs running down to the Abschwung; the thinner represents the range of the Strahlhörner, crossed by the Strahleck pass close to its origin. Mr. Anderson, in the former volume of "Peaks and Passes," describes an attempt to ascend the Schreckhorn, made by him under most unfavourable circumstances; one of his guides, amongst other misfortunes, being floored by a falling stone, and he and his guides together nearly swept away by an avalanche. His courage, however, did not meet with the reward it fully deserved, as bad weather made it impossible for him to attempt more than the Little Schreckhorn, the summit of which he succeeded in reaching. A more successful attack had

* A Countess Dora d'Istria has published an account of an ascent of the Mönch, previous to this. Though I should be sorry to be uncivil to a lady, I must confess that the account bears strong internal evidence of describing an ascent to a point which was not the top. Inquiries on the spot have confirmed the truth of this conjecture.



THE SCHRECKHORN FROM THE GRINDELWALD GLACIER.

been made by MM. Desor and Escher von der Linth, in 1842. Starting from the Strahleck, they had climbed, with considerable difficulty, to a ridge leading apparently to the summit of the Schreckhorn. After following this for some distance, they were brought to a stand-still by a sudden depression some ten or twelve feet in depth, which was succeeded by a very sharp arête of snow. Whilst they were hesitating what to do, one of the guides, in spite of a warning shriek from his companions, and without waiting for a rope, suddenly sprang down so as to alight astride of the ridge. They followed him more cautiously, and, animated to the task by a full view of the summit, forced their way slowly along a very narrow and dangerous arête. They reached the top at last triumphantly, and, looking round at the view, discovered, to their no small disgust, that to the north of them was another summit. They had indeed proved, by a trigonometrical observation, that that on which they stood was the highest; but, in spite of trigonometry, the northern peak persisted in looking down on them. As it was cut off from them by a long and impracticable arête some three hundred yards (in my opinion more) in length, they could do nothing but return, and obtain another trigonometrical observation. This time the northern peak came out twenty-seven metres (about eighty-eight feet) the higher. It was, moreover, to all appearance, the harder piece of work. As Ulrich Lauener (who, I must admit, is rather given to croaking) once said to me, it was like the Matterhorn, big above and little below, and he would have nothing to do with it. I resolved, however, to try to conquer this last stronghold of the Oberland mountains.

Accordingly, on the night of the 13th August, 1861, I found myself the occupant of a small hole under a big rock near the northern foot of the Strahleck. Owing to

bad diplomacy, I was encumbered with three guides,—Peter and Christian Michel, and Christian Kaufmann,—all of them good men, but one, if not two, too many. As the grey morning light gradually stole into our burrow, I woke up with a sense of lively impatience—not diminished, perhaps, by the fact that one side of me seemed to be permanently impressed with every knob in a singularly cross-grained bit of rock, and the other with every bone in Kaufmann's body. Swallowing a bit of bread, I declared myself ready. An early start is of course always desirable before a hard day's work, but it rises to be almost agreeable after a hard night's rest. This did not seem to be old Peter Michel's opinion. He is the very model of a short, thick, broad mountaineer, with the constitution of a piece of seasoned oak; a placid, not to say stolid, temper; and an illimitable appetite. He sat opposite me for some half-hour, calmly munching bread and cheese, and meat and butter, at four in the morning, on a frozen bit of turf, under a big stone, as if it were the most reasonable thing a man could do under the circumstances, and as though such things as the Schreckhorn and impatient tourists had no existence. A fortnight before, as I was told, he had calmly sat out all night, half-way up the Eiger, with a stream of freezing water trickling over him, accompanied by an unlucky German, whose feet received frost-bites on that occasion, from which they were still in danger, while old Michel had not a chilblain. At last, however, about half-past four, we got deliberately under weigh. Our first two or three hours' work was easy enough. The two summits of the Schreckhorn form as it were the horns of a vast crescent of precipice, which runs round a secondary glacier, on the eastern bank of the Grindelwald glacier. This glacier is skirted on the south by the ordinary Strahleck route, and is marked on the accompanying map. The cliffs above

it are for the most part bare of snow, and scored by deep trenches or gullies, the paths of avalanches, and of the still more terrible showers of stones, which, in the later part of the day, may be seen every five minutes discharged down the flank of the mountain. I was very sanguine that we should reach the arête connecting the two peaks. I felt doubtful, however, whether we could pass along it to the summit, as it might be interrupted by some of those gaps which so nearly stopped Desor's party. Old Michel indeed had declared, on a reconnoitring expedition I had made with him the day before, that he believed, "*steif und fest*," that we could get up. But as we climbed the glacier my faith in Michel and Co. began to sink, not from any failing in their skill as guides, but from the enormous appetites which they still chose to exhibit. Every driblet of water seemed to be inseparably connected in their minds with a drop of brandy, and every flat stone suggested an open-air picnic. Perhaps my impatience rather exaggerated their delinquencies in this direction; but it was not till past seven, when we had deposited the heavy part of our baggage, and, to my delight, most of the provisions, on a ledge near the foot of the rocks, that they fairly woke up and settled to their work. From that time I had no more complaints to make. We soon got hard and steadily at work, climbing the rocks which form the southern bank of one of the deeply carved gullies of which I have spoken. It seemed clear to me that the summit of the Schreckhorn, which was invisible to us at present, was on the other side of this ravine, its northern bank being in fact formed by a huge buttress running straight down from the peak. This buttress was cut into steps, by cliffs so steep as to be perfectly impracticable; in fact, I believe that in one place it absolutely overhung. It was therefore necessary to keep to the other side; but I felt an unpleasant suspicion that

the head of the ravine might correspond with an impracticable gap in the arête.

Meanwhile we had simply a steady piece of rock-climbing. Christian Michel, a first-rate cragsman, led the way. Kaufmann followed, and, as we clung to the crannies and ledges of the rock, relieved his mind by sundry sarcasms as to the length of arm and leg which enabled me to reach points of support without putting my limbs out of joint. The rocks were steep and slippery, and occasionally covered with a coat of ice. We were frequently flattened out against the rocks, like beasts of ill repute nailed to a barn, with fingers and toes inserted into four different cracks which had been obviously arranged without the slightest regard to the convenience of the human figure. Still our progress though slow was steady, and would have been agreeable if only our minds could have been at ease with regard to that detestable ravine. We could not obtain a glimpse of the final ridge, and we might be hopelessly stopped at the last step. Meanwhile, as we looked round, we could see the glacier basins gradually sinking, and the sharp pyramid of the Finsteraarhorn shooting upwards above them. Gradually, too, the distant ranges of Alps climbed higher and higher up the southern horizon. From Mont Blanc to Monte Rosa, and away to the distant Bernina, ridge beyond ridge rose into the sky, with many a well-remembered old friend amongst them. In two or three hours' work we had risen high enough to look over the ridge connecting the two peaks, down the long reaches of the Aar glaciers. A few minutes afterwards we caught sight of a row of black dots creeping over the snows of the Strahleck. With a telescope I could just distinguish a friend whom I had met the day before at Grindelwald. A loud shout from us brought back a faint reply or echo. We were already high above the pass. Still, however,

that last arête remained pertinaciously invisible. A few more steps, if steps is a word applicable to progression by hands as well as feet, placed us at last on the great ridge of the mountain, looking down upon the Lauteraar Sattel. But the ridge rose on our right hand into a kind of knob, which allowed only a few yards of it to be visible. Taking a drop of brandy all round, we turned to the assault, feeling that a few yards more would decide the question. On our right hand, the long slopes of snow ran down towards the Lauteraar Sattel, as straight as if the long furrows on their surface had been drawn by a ruler. They were in a most ticklish state. The snow seemed to be piled up like loose sand, at the highest angle of rest, and almost without cohesion. The fall of a pebble or a handful of snow was sufficient to detach a layer, which slid smoothly down the long slopes with a long low hiss. Clinging, however, to the rocks which formed the crest of the ridge, we dug our feet as far as possible into the older snow beneath, and crept cautiously along. As soon as there was room on the arête, we took to the rocks again, and began, with breathless expectation, climbing the knob of which I have spoken. The top of the mountain could not remain much longer concealed. A few steps more, and it came full in view. The next step revealed to me not only the mountain top, but a lovely and almost level ridge which connected it with our standing-point. We had won the victory, and, with a sense of intense satisfaction, attacked the short ridge which still divided us from our object. It is melancholy to observe the shockingly bad state of repair of the higher peaks, and the present was no exception to the rule. Loose stones rattled down the mountain sides at every step, and the ridge itself might be compared to the ingenious contrivance which surmounts the walls of gaols with a nicely balanced pile of

loose bricks,—supposing the interstices in this case to be filled with snow. We crept, however, cautiously along the parapet, glancing down the mighty cliffs beneath us, and then, at two steps more, we proudly stepped (at 11.40) on to the little level platform which forms the “aller höchste Spitze” of the Schreckhorn.

I need hardly remark that our first proceeding was to give a hearty cheer, which was faintly returned by the friends who were still watching us from the Strahleck. My next was to sit down, in the warm and perfectly calm summer air, to enjoy a pipe, and the beauties of nature, whilst my guides erected a cairn of stones round a large black flag which we had brought up to confute cavillers. Mountain tops are always more or less impressive in one way,—namely, from the giddy cliffs which surround them. But the more distant prospects from them may be divided into two classes: those from the Wetterhorn, Jungfrau, or Monte Rosa, and other similar mountains, which include on one side the lowland countries, forming a contrast to the rough mountain ranges; and those from mountains standing, not on the edge, but in the very centre of the regions of frost and desolation. The Schreckhorn (like the Finsteraarhorn) is a grand example of this latter kind. Four great glaciers seem to radiate from its base. The great Oberland peaks—the Finsteraarhorn, Jungfrau, Mönch, Eiger, and Wetterhorn—stand round in a grim circle, showing their bare faces of precipitous rock across the dreary wastes of snow. At your feet are the huge basins of snow from which the glaciers of Grindelwald draw the supplies that enable them to descend far into the regions of cultivated land, trickling down like great damp icicles, of insignificant mass compared with these mighty reservoirs. You are in the centre of a whole district of desolation, such as that to which I presume the hills of England would be reduced if it were

not for that blessed Gulf Stream. After an hour's contemplation of the view, I added a few touches to our cairn, and then turned to the descent. It is a general opinion, with which I do not agree, that the descent of slippery or difficult rock is harder than the ascent. My guides, however, seemed to be fully convinced of it; or perhaps they merely wished to prove, in opposition to my sceptical remarks, that there was some use in having three guides. Accordingly, whilst Christian Michel led the way, old Peter and Kaufmann persisted in planting themselves steadily in some safe nook, and then hauling at the rope round my waist. By a violent exertion and throwing all my weight on to the rope, I gradually got myself paid slowly out, and descended to the next ledge, feeling as if I should be impressed with a permanent groove to fix ropes to in future. The process was laborious, not to say painful, and I was sincerely glad when the idea dawned upon the good fellows that I might be trusted to use my limbs more freely.

I was once still more annoyed by an old guide on the Bietschhorn, who had solemnly informed me that his name was in *The Book*, *i. e.* Murray. Having done nothing all day to maintain his reputation, he seized a favourable opportunity as we were descending a narrow arête of snow, and suddenly clutching my coat-tails, on pretence of steadying me, brought me with a jerk into a sitting position. My urgent remonstrances only produced bursts of *patois*, mixed with complacent chucklings, and I was forced to resign myself to the fate of being pulled backwards, all in a heap, about every third step along the arête. The process gave the old gentleman such evident pleasure that I ceased to complain.

On the present occasion my guides were far more reasonable, and I would never complain of a little extra caution. We were soon going along steadily enough,

though the slippery nature of the rocks, and the precautions necessary to avoid dislodging loose stones, made our progress rather slow. At length, however, with that instinct which good guides always show, and which amateurs are most deficient in, we came exactly to the point where we had left our knapsacks. I have often been so much puzzled by the extreme difference in the appearance of the same rocks when ascending or descending, that I never fail to remark the skill which practice gives the natives in hitting off a path which they have once taken. We were now standing close to the ravine I have mentioned. Suddenly I heard a low hiss close by me, and looking round saw a stream of snow shooting rapidly down the gully, like a long white serpent. It was the most insidious enemy of the mountaineer — an avalanche; not such as thunders down the cliffs of the Jungfrau, ready to break every bone in your body, but the calm malicious avalanche which would take you quietly off your legs, wrap you up in a sheet of snow, and bury you in a crevasse for a few hundred years, without making any noise about it. The stream was so narrow and well defined that I could easily have stepped across it; still it was rather annoying, inasmuch as immediately below us was a broad fringe of snow ending in a bergschrund, the whole being in what travellers used to represent as the normal condition of mountain snow — such that a stone, or even a hasty expression, rashly dropped, would probably start an avalanche. Christian Michel showed himself equal to the occasion. Choosing a deep trench in the snow — the channel of one of these avalanches — from which the upper layer of snow was cut away, he turned his face to the slope and dug his toes deeply into the firmer snow beneath. We followed, trying in every way to secure our hold of the treacherous footing. Every little bit of snow that we kicked aside started a young avalanche on its

own account. By degrees, however, we reached the edge of a very broad and repulsive-looking bergschrund. Unfixing the rope, we gave Kaufmann one end, and sent him carefully across a long and very shaky-looking bridge of snow. He got safely across, and we cautiously followed him, one by one. As the last man reached the other side, we felt that our dangers were over. It was now about five o'clock.

We agreed to descend by the Strahleck. Great delay was caused by our discovering that even on the nearly level surface there was a sheet of ice formed, which required many a weary step to be cut. It was long before we could reach the rocks and take off the rope for a race home down the slopes of snow.

As we reached our burrow we were gratified with one of the most glorious sights of the mountains. A huge cloud, which looked at least as lofty as the Eiger, rested with one extremity of its base on the Eiger and the other on the Mettenberg, shooting its white pinnacles high up into the sunshine above. Through the mighty arched gateway thus formed, we could see far over the successive ranges of inferior mountains, standing like flat shades one behind another. The lower slopes of the Mettenberg glowed with a deep blood-red, and the more distant hills passed through every shade of blue, purple, and rose-coloured hues, into the faint blue of the distant Jura, with one gleam of green sky beyond. In the midst of the hills, the lake of Thun lay, shining like gold. A few peals of thunder echoed along the glacier valley, telling us of the storm that was raging over Grindelwald.

It was half-past seven when we reached our lair. We consequently had to pass another night there; a necessity which would have been easily avoided by a little more activity in the morning. With this exception, I had every

reason to be satisfied with my guides, especially with Christian Michel, who is a first-rate man.

Perhaps I may be allowed to add a note on the geography of the Oberland. There is, I suppose, no better known pass than the Strahleck, and yet it is laid down entirely wrong in every map that I have seen. The ridge joining the Finsteraarhorn and Schreckhorn has no existence, as I can testify after careful observations from the Finsteraarhorn, Schreckhorn, and Oberaarhorn. The spur of the Schreckhorn, called Strahlhörner, runs towards the Oberaarhorn or nearly so, but does not join it. Thus the great basin of *névé* under the Finsteraarhorn communicates with unbroken glacier, both with the Grindelwald and Aar glaciers. The old Strahleck pass used (as I have been told by M. Anderegg) to lie across this basin.* It was changed for the route over the Strahlhörner, because the glacier became too much crevassed near the Oberaarhorn.

* See map in this edition.

2. THE EIGER JOCH, A PASS FROM THE WENGERN ALP
TO THE JEGGISCH-HORN, BETWEEN THE MONCH AND
THE EIGER, MADE BY MESSRS. WILLIAM AND GEORGE
MATHEWS AND THE REV. LESLIE STEPHEN ON THE
7TH OF AUGUST, 1859.

BY THE REV. LESLIE STEPHEN, M.A.

ON the 3rd of August, 1859, I was travelling on the Swiss railway, between Basle and Olten, with my friends Messrs. William and George Mathews. As we shot out of the long tunnel above Olten and descended into the valley of the Aar, the glorious range of the Bernese Oberland rose majestically into sight, some fifty miles away. While telling over the names of our gigantic friends, our eyes were caught by the broad flat top of the Mönch, which no Englishman had yet reached. It occurred to us that an attack upon this hoary pillar of the mid-aerial church would be a worthy commencement of our expedition, and it struck us at the same time that by ascending, as a first step, the ridge called by Mr. Bunbury* the Col de la Jungfrau, which connects the Mönch with the Jungfrau, we should, so to speak, be killing two birds with one stone. Mr. Bunbury indeed states, that on looking down from this ridge, he and his guide had considered an ascent from the northern side to be quite impracticable; but as "impracticable" is generally used in the Alps to signify that an ascent has never been tried, we considered ourselves fully justified in

* In the former volume of "Peaks, Passes, and Glaciers."

attempting what, if successful, would be a first-rate and completely new pass.

Accordingly, on the 5th of August we assembled at the lower of the two little inns on the Wengern Alp. The Mathews were accompanied by two Chamounix men, Jean-Baptiste Croz and Charlet, whilst I had secured the gigantic Ulrich Lauener,—not without some grumbling on his part at being joined with Chamounix guides. We now examined the work before us more closely. The Mönch is connected by two snow-ridges, with the Jungfrau on the west and the Eiger on the east. From the first of these ridges descends the Guggi glacier, and from the second the Eiger glacier, both of them pouring their torrents into the gloomy Trümleten valley, the trench which also receives the snow avalanches of the Jungfrau. These two glaciers are separated by the huge northern buttress of the Mönch, and which, I believe, is generally supposed by tourists to be perpendicular, but the long slopes of débris by which it is faced, prove the fallacy of this idea to an experienced eye, and it is in fact easy to ascend. Both glaciers are much crevassed; the Guggi, however, expands into a kind of level plateau, about half-way up the mountain, connected by long and broken snow-slopes with the Col de la Jungfrau.

The morning of the 6th having been gloomy, we spent the later part of the day in a reconnoitring expedition up to this plateau and a little beyond it. The result of our observations was not encouraging. We mounted some way above the plateau on a great heap of débris that had been disgorged by a glacier above. The blue crevasses which were drawn across the protruding nose of ice showed that at any minute we might be surprised by the descent of new masses, which would convert us into débris ourselves. Even if we surmounted this danger in the early

morning, the steep slopes of *névé* above us, which occasionally bulged out into huge overhanging masses, looked far from promising. Retreating to the buttress of the *Mönch*, we turned our attention to the *Eiger* glacier. Though some difficulties were obviously to be encountered, its aspect was generally more auspicious, and we accordingly resolved to modify our plans by ascending the eastern instead of the western shoulder of the *Mönch*. We hoped afterwards to attack the *Mönch*, but in any case meant to descend to the *Aletsch* glacier on the other side.

An additional result of our expedition had been to develop a decided rivalry between *Lauener* and the *Chamounix* men. We had already had one or two little races and disputations in consequence, and *Lauener*, if he could have spoken English, would have said that the *Savoyards* were "muffs." As, however, he could not speak a word of French, nor they of German, he was obliged to convey this sentiment in pantomime, which perhaps did not soften its vigour. I was accordingly prepared for a few disputes the next day,—an annoyance which generally attends a combination of Swiss and *Chamounix* guides.

About 4 on the morning of the 7th of August we got off from the inn on the *Wengern Alp*, notwithstanding a few delays, and steered straight for the foot of the *Eiger*. In the early morning the rocks around the glacier and the lateral moraines were hard and slippery. Before long, however, we found ourselves well on the ice, near the central axis of the *Eiger* glacier, and looking up at the great terrace-shaped ice-masses, separated by deep crevasses, which rose threateningly over our heads, one above another, like the defences of some vast fortification. And here began the first little dispute between *Oberland* and *Chamounix*. The *Chamounix* men proposed a direct assault on the network of crevasses above us. *Lauener* said that

we ought to turn them by crossing to the south-west side, immediately below the Mönch. My friends and their guides forming a majority, and seeming to have little respect for the arguments urged by the minority, we gave in and followed them, with many muttered remarks from Lauener. We soon found ourselves performing a series of manœuvres like those required for the ascent of the Col du Géant. At times we were lying flat in little gutters on the faces of the seracs, worming ourselves along like boa-constrictors. At the next moment we were balancing ourselves on a knife-edge of ice between two crevasses, or plunging into the very bowels of the glacier, with a natural arch of ice meeting above our heads. I need not attempt to describe difficulties and dangers familiar to all ice-travellers. Like other such difficulties, they were very good fun whilst they lasted, but unfortunately they seemed inclined to last rather too long. Some of the deep crevasses apparently stretched almost from side to side of the glacier, rending its whole mass into distorted fragments. In attempting to find a way through them, we seemed to be going nearly as far backwards as forwards, the labyrinth in which we were involved being apparently as hopelessly intricate as it had been at first. Moreover, the sun had long touched the higher snow-fields, and was creeping down to us step by step. As soon as it reached the huge masses amongst which we were painfully toiling, some of them would begin to jump about like hailstones in a shower, and our position would become really dangerous. The Chamounix guides, in fact, declared it to be dangerous already, and warned us not to speak for fear of bringing some of the nicely poised ice-masses down on our heads. On my translating this well-meant piece of advice to Lauener, he immediately selected the most dangerous-looking pinnacle in sight, and mounting to the top of it

sent forth a series of screams, loud enough, I should have thought, to bring down the top of the Mönch. They failed, however, to dislodge any seracs, and Lauener, going to the front, called to us to follow him. By this time we were all glad to follow any one who was confident enough to lead. Turning to our right, we crossed the glacier in a direction parallel to the deep crevasses, and therefore unobstructed by any serious obstacles, till we found ourselves immediately beneath the great cliffs of the Mönch. Our prospects changed at once. A great fold in the glacier (visible in the illustration) produces a kind of diagonal pathway, stretching upwards from the point where we stood towards the rocks of the Eiger;—not that it was exactly a carriage-road—but along the line which divides two different systems of crevasse, the glacier seemed to have been crushed into smaller fragments, producing, as it were, a kind of incipient macadamisation. The masses, instead of being divided by long regular trenches, were crumbled and jammed together so as to form a road, easy and pleasant enough by comparison with our former difficulties. Pressing rapidly up this rough path, we soon found ourselves in the very heart of the glacier, with a broken wilderness of ice on every side. We were in one of the grandest positions I have ever seen for observing the wonders of the ice-world; but those wonders were not all of an encouraging nature. For, looking up to the snow-fields now close above us, an obstacle appeared which made us think that all our previous labours had been in vain. From side to side of the glacier a vast *chevaux de frise* of blue ice-pinnacles struck up through the white layers of névé formed by the first plunge of the glacier down its waterfall of ice. Some of them rose in fantastic shapes,—huge blocks balanced on narrow footstalks, and only waiting for the first touch of

the sun to fall in ruins down the slope below. Others rose like church spires, or like square towers, defended by trenches of unfathomable depth. Once beyond this barrier, we should be safe upon the highest plateau of the glacier at the foot of the last snow-slope. But it was obviously necessary to turn them; it would be impossible to force a passage through them. One plan was to climb the lower rocks of the Eiger; but, after a moment's hesitation, we fortunately followed Lauener towards the other side of the glacier, where a small gap, between the seracs and the lower slopes of the Mönch, seemed to be the entrance to a ravine that might lead us upwards. Such it turned out to be. Instead of the rough footing to which we had hitherto been unwillingly restricted, we found ourselves ascending a narrow gorge, with the giant cliffs of the Mönch on our right, and the toppling ice-pinnacles on our left. A beautifully even surface of snow, scarcely marked by a single crevasse, lay beneath our feet. We pressed rapidly up this strange little pathway, as it wound steeply upwards between the rocks and the ice, expecting at every moment to see it thin out, or break off at some impassable crevasse. It was, I presume, formed by the sliding of avalanches from the slopes of the Mönch. At any rate, to our delight it led us gradually round the barrier of seracs, till in a few minutes we found ourselves on the highest plateau of the glacier, the crevasses fairly beaten, and a level plain of snow stretching from our feet to the last snow-slope.

We were now standing on the edge of a small level plateau. (It is not seen in the illustration, but lies between the highest seracs marked there and the final snow-slope.) One, and only one, gigantic crevasse of really surpassing beauty stretched right across it. This was, we guessed, some three hundred feet deep, and its sides

passed gradually into the lovely blues and greens of semi-transparent ice, whilst long rows and clusters of huge icicles imitated (as Lauener remarked) the carvings and ecclesiastical fixings of some great cathedral. The opposite side of the plain was bounded by a great snow-ridge, which swept round it in a long semicircular curve from the Mönch to the Eiger. This ridge, in fact, forms the connecting isthmus by which the great promontory of the Eiger is joined to its brethren of the Oberland. Close to the Mönch the slopes (as shown in the illustration) are of great height and steepness, whilst, owing to the gradual rise of the snow-fields and the sinking of the ridge, they become very insignificant at the end next to the Eiger. A reference to the map will explain the geography of our position. The pass which we were attempting would naturally lie over the shoulder, where the connecting isthmus I have mentioned articulates with the lower ridges of the Mönch. Lauener had, in fact, reached this exact point from the other side. And we knew that, once there, we should be on the edge of a nearly level basin of snow, which stretches across the Mönch Joch, or ridge connecting the Mönch with the Walcherenhörner. This basin is in fact the common source of the Aletsch and Viescher* glaciers, and the mound of the Mönch Joch which divides them is very slightly defined across the undulating beds of névé. From this basin, however, the Viescher glacier sinks very rapidly, and consequently the ridge between the Mönch and Eiger, which rises above it in bare rock cliffs, is much loftier near the Eiger than near the Mönch on its south-eastern side,—the exact opposite of its form

* The best known Viescher glacier is, of course, that which descends from the Oberaarjoch towards Viesch. The glacier mentioned in the text is the great tributary of the lower Grindelwald glacier, called "Viescher" glacier in the Carte Dufour.

on the north-western side, as already mentioned. Hence, to reach our pass, we had the choice — either of at once attacking the long steep slopes which led directly to the desired point on the shoulder of the Mönch, or of first climbing the gentle slopes near the Eiger, and then forcing our way along the back-bone of the ridge. We resolved to try the last plan first.

Accordingly, after a hasty breakfast at 9.30, we started across our little snow-plain and commenced the ascent. After a short climb of no great difficulty, merely pausing to chip a few steps out of the hard crust of snow, we successively stepped safely on to the top of the ridge. As each of my predecessors did so, I observed that he first looked along the arête, then down the cliffs before him, and then turned with a very blank expression of face to his neighbour. From our feet the bare cliffs sank down, covered with loose rocks, but too steep to hold more than patches of snow, and presenting right dangerous climbing for many hundred feet towards the Grindelwald glaciers. The arête offered a prospect not much better: a long ridge of snow, sharp as the blade of a knife, was playfully alternated with great rocky teeth, striking up through their icy covering like the edge of a saw. We held a council standing, and considered the following propositions: — First, Lauener coolly proposed, and nobody seconded, a descent of the precipices towards Grindelwald. This proposition produced a subdued shudder from the travellers and a volley of unreportable language from the Chamounix guides. It was liable, amongst other things, to the trifling objection that it would take us just the way we did not want to go. The Chamounix men now proposed that we should follow the arête. This was disposed of by Lauener's objection that it would take at least six hours. We should have had to cut steps down the slope and up

again round each of the rocky teeth I have mentioned; and I believe that this calculation of time was below the mark. Finally, we unanimously resolved upon the only course open to us, to descend once more into our little valley, and thence to cut our way straight up the long slopes to the shoulder of the Mönch.

Considerably disappointed at this unexpected check, we retired to the foot of the slopes, feeling that we had no time to lose, but still hoping that a couple of hours more might see us at the top of the pass. It was just 11 as we crossed a small bergschrund and began the ascent. Lauener led the way to cut the steps, followed by the two other guides, who deepened and polished them up. Just as we started, I remarked a kind of bright track drawn down the ice in front of us, apparently by the frozen remains of some small rivulet which had been trickling down it. I guessed it would take some fifty steps and half an hour's work to reach it. We cut about fifty steps, however, in the first half-hour, and were not a quarter of the way to my mark; and as even when there we should not be half-way to the top, matters began to look serious. The ice was very hard, and it was necessary, as Lauener observed, to cut steps in it as big as soup-tureens, for the result of a slip would in all probability have been that the rest of our lives would have been spent in sliding down a snow-slope, and that that employment would not have lasted long enough to become at all monotonous. Time slipped by, and I gradually became weary of a sound to which at first I always listen with pleasure,—the chipping of the axe, and the hiss of the fragments as they skip down the long incline below us. Moreover, the sun was very hot, and reflected with oppressive power from the bright and polished surface of the ice. I could see that a certain flask was circulating with great steadiness amongst the

guides, and the work of cutting the steps seemed to be extremely severe. I was counting the 250th step, when we at last reached the little line I had been so long watching, and it even then required a glance back at the long line of steps behind to convince me that we had in fact made any progress. The action of resting one's whole weight on one leg for about a minute, and then slowly transferring it to the other, becomes wearisome when protracted for hours. Still the excitement and interest made the time pass quickly. I was in constant suspense lest Lauener should propose a retreat, which would have been annoying, and listened with some amusement to the low moanings of little Charlet, who was apparently bewailing his position to Croz, and being heartlessly chaffed in return. One or two measurements with a clinometer of Mathews' gave inclinations of 51° or 52° , and the slope was perhaps occasionally a little more.

At last, as I was counting the 580th step, we reached a little patch of rock (visible in the illustration), and felt ourselves once more on solid ground with no small satisfaction. Not that the ground was specially solid. It was a small crumbling patch of rock, and every stone we dislodged went bounding rapidly down the side of the slope, diminishing in apparent size till it disappeared in the bergschrund, hundreds of feet below. However, each of us managed to find some nook in which he could stow himself away, whilst the Chamounix men took their turn in front, and cut steps straight upwards to the top of the slope. By this means they kept along a kind of rocky rib, of which our patch was the lowest point, and we thus could occasionally get a footstep on rock instead of ice. Once on the top of the slope, we could see no obstacle intervening between us and the point over which our pass must lie.

Meanwhile we meditated on our position. It was already 4 o'clock. After twelve hours' unceasing labour we were still a long way on the wrong side of the pass. We were clinging to a ledge in the mighty snow-wall which sank sheer down below us and rose steeply above our heads. Beneath our feet the whole plain of Switzerland lay with a faint purple haze drawn over it like a veil, a few green sparkles just pointing out the lake of Thun. Nearer, and apparently almost immediately below us, lay the Wengern Alp, and the little inn we had left twelve hours before, whilst we could just see the back of the labyrinth of crevasses where we had wandered so long. Through a telescope I could even distinguish people standing about the inn, who no doubt were contemplating our motions. Meanwhile the Chamounix guides had cut a staircase up the slope, and we prepared to follow. It was harder work than before, for the whole slope was now covered with a kind of granular snow, and resembled a huge pile of hailstones. The hailstones poured into every foot-step as it was cut, and had to be cleared out with hands and feet before we could get even a slippery foot-hold. As we crept cautiously up this treacherous staircase, I could not help reflecting on the lively bounds with which the stones and fragments of ice had gone spinning from our last halting-place down to the yawning bergschrund below. We succeeded, however, in avoiding their example, and a staircase of about one hundred steps brought us to the top of the ridge, but at a point still at some distance from the pass. It was necessary to turn along the arête towards the Mönch. We were preparing to do this by keeping on the snow-ridge, when Lauener, jumping down about six feet on the side opposite to that by which we had ascended, lighted upon a little ledge of rock and called to us to follow. He assured us that it was granite,

and that therefore there was no danger of slipping. It was caused by the sun having melted the snow on the southern side of the ridge, so that it no longer quite covered the inclined plane of rock upon which it rested. It was narrow and treacherous enough in appearance at first—soon, however, it grew broader, and, compared with our ice-climb, afforded capital footing. The precipice beneath us thinned out as the Viescher glacier rose towards our pass, and at last we found ourselves at the edge of a little mound of snow, through which a few plunging steps brought us, just at 6 o'clock, to the long-desired shoulder of the Mönch.

I cannot describe the pleasure with which we stepped at last on to the little saddle of snow, and felt that we had won the victory. We had made a pass equal in beauty and difficulty to any first-rate pass in the Alps,—I should rather say to any pass and a half. For, whereas most such passes can show but two fine views, here we have three. From the time of our reaching the summit of the ridge we had been enveloped in a light mist. Shortly after we had gained the col, this mist suddenly drew up like a curtain; and as mountain after mountain came out in every direction from a point of view quite new to me, I felt perfectly bewildered. We were on the edge of three great basins. Behind us the plain of Switzerland stretched away to the Jura. On our left a huge amphitheatre of glacier sank down, marked in long concentric curves by tier after tier of crevasses to the level of the Grindelwald glacier. Beyond rose the sheer cliffs of the Wetterhorn, and further back from the plain the black cluster of rocks of the Schreckhörner. This view is invisible from the Col de la Jungfrau, and is so eminently beautiful that I should recommend visitors from the Æggisch-horn to prefer this col to the other. It is as easily reached from the southern

side, and is alone worth the trouble, if it be not profane to speak of the trouble of such a walk. But the finest part of the view remains. We were standing at the edge of a great basin of snow. From its further side the great Aletsch glacier stretched away from our feet like the reach of some gigantic river frozen over, and covered from side to side with a level sheet of pure white snow, sweeping gradually away in one grand curve till it was lost to sight in the distance. Beyond it rose the Monte Leone and the ranges that look down on Italy. On each side rose some of the noblest mountains in Switzerland,—the Jungfrau, Mönch, Aletschhorn, and the long jagged range of the Viescherhörner, with the needle-point of the Finsteraarhorn overlooking them. So noble and varied a sweep of glacier is visible nowhere else in the Alps.

We had a little discussion during our halt as to the name which we should give as first discoverers. One of the party, with a glance down the long snow-slope, suggested Teufels Joch as an appropriate name. Lauener, with more piety but less point, proposed Engels Joch, in gratitude to the good angels who had brought us up. The name, however, clearly ought to be Eiger Joch. The ridge connecting the Mönch to the Jungfrau is known as the Jungfrau Joch,—that between the Mönch and the Walcherehörner has been christened Mönch Joch, probably for the sake of euphony. It is in analogy with these names, and suggests also, that, as our pass was ascended from the Eiger glacier, it should be called Eiger Joch.

I will confess, however, that my first inquiry on the top of a new pass is neither what is there to see, nor what is the pass to be called, but — what is there to eat? Of the two requisites for a satisfactory meal, one, viz. the provisions, was abundantly present. I fancied too, at first,

that my appetite would do its part; but on trying to swallow some meat, I found that our long fast since the last meal, combined with the baking we had undergone, had so parched my mouth that the effort was useless. My thoughts turned to a refreshing cup of tea and a bed at the *Äggisch-horn*. But, alas! the inn was seven hours off: it was 6 P.M., and the sun near setting. Lauener mentioned certain *wolldecken* and some coffee, which he believed to be at the Faulberg; and the Faulberg, though we knew it to be one of those caves from which the whole of one side and the roof have been removed, immediately seemed to us to be the pleasantest hotel in Switzerland. We started off with enthusiasm to gain it. Passing rapidly round the great snow-basin between the Mönch and the Trugberg, we came to a place where the whole breadth of the glacier seems to tumble in,—a broad curve over a kind of weir. At foot of the fall, which is perhaps some fifty feet high, is a bergschrund. Lauener, planting his feet in the snow above, prepared to lower each of us by the rope. Suddenly G. Mathews lost his footing, shot down the slope like a flash of lightning, and disappeared over the edge of the bergschrund. To our great relief, we immediately heard him call out “all right,” and the next moment he appeared full of snow, but otherwise none the worse for his involuntary glissade. We followed with the help of the rope, and started down the glacier once more. We were scarcely off when the broad reach before us turned first to a glorious rose colour, and then faded to a livid hue as the light crept up the sides of the mountains. Soon they too turned pale; the glow lingered a little on the loftiest peaks, then faded, too, and left us to the light of the moon, which was still clear enough to guide us.

Lauener took this opportunity of remarking that he had

been very unwell for three days before, and was consequently rather tired. He added presently that he could not see, and did not in the least know where he was going. I do not implicitly believe either of these statements, which struck me as being rather ill-timed. However, we marched steadily forwards in a long straggling line over the beautifully even surface of the glacier, already crisp with the evening frost, anxiously watching the sinking moon, and calculating whether her light would enable us to reach the Faulberg.

We were making good progress, and the hospitable Faulberg was coming almost into sight, when we reached the point where the glacier curls over for a steep descent, just above the confluence of the glaciers from the Lötschsattel and Grünhornlücke. Here a few concealed crevasses, causing the partial disappearance of some of our party, made a resort to the rope necessary. Fastening ourselves together we again pressed on as fast as we could. But the crevasses grew more numerous and broader, and the surface of the ice more steeply inclined. In the faint moonlight we could hardly tell what we were treading upon, —treacherous snow-bridges or slippery slides of ice. A stumble or two nearly brought us all in a heap together. Moreover, the Aletschhorn had chosen to shove its head up just in the way of the moon, and at last, as we were all getting rather puzzled how to proceed, the moon suddenly dipped behind it, the great shadow of the mountain shot out over us, and we were left all alone in the dark. Looking hastily round in the faint twilight, we could just make out a great mass of rock on our right hand. This forms part of the great promontory called the Kranzberg, which divides the two main branches of the Aletsch glacier. We made for it at once, found no crevasses to stop us, and stepped once more off the ice on to dry land. We unanimously resolved

to stay where we were till daylight should appear. We unfastened the ropes, took a glass of wine all round, and determined to make ourselves comfortable. I accomplished this desirable object as follows:— Having drunk my wine, and made a perfectly futile attempt to swallow a bit of bread, I put on a pair of dry stockings which I had in my pocket over my wet ones, stuck my feet into a knapsack, and sat down on some sharp stones under a big rock. My companions most obligingly sat down on each side of me, which tended materially to keep off the cold night wind, and one of them shared my knapsack. My seat may very easily be imitated by any one who will take the trouble to fill one of the gutters by the side of a paved street with a heap of granite stones prepared for macadamising a road. If he will sit down there for a frosty night, and induce a couple of friends to sit with him, he will doubtless learn to sympathise with us. Lauener carefully warned us not to go to sleep, and I think I may say we fulfilled our promise of obeying his injunctions, with the exception of a doze or two towards morning. Lauener came out very strong. His good temper and fun seemed to rise with the occasion; and after telling us a variety of anecdotes, beginning with chamois-hunting and ending (of all things in the world) with examinations,—for it seems that Swiss guides share, with under-graduates, this particular form of misery,—he retired to the nook which the Chamounix guides had selected, and, to the best of my belief, passed the rest of the night in chaffing them.

There is, of course, something disagreeable in passing a night “squirming” (to use an Americanism) on a heap of stones, and making fruitless endeavours to arrange their sharp corners into a soft surface to sit upon, by a series of scientific wriggles. I fully expected to get up in the morning stuck all over with pebbles, like a large pat of

butter dropped into a sugar basin. In other respects, I believe I really enjoyed the night. The cold was not intense, and in fact I rarely felt it at all. Partly the excitement, and partly the beauty of the perfectly still and silent night, prevented its seeming long. The huge snow-covered mountains that glimmered faintly through the darkness, the long glorious glacier, half seen as it swept away from our feet, and the perfect stillness of the scene, were very striking. We felt that our little party was in absolute solitude in the very centre of the greatest waste of ice and bare rock in the Alps. I will not deny that towards morning I got a little chilly, not to say sulky. Gradually the mountain forms became more distinct. The outlines of rock and snow showed themselves more plainly, and I was quite surprised, on looking at my watch for the first time, to find that it was half-past two, and to see Lauener coming to tell us it was time to start.

We jumped up, shook ourselves, struggled into our frozen boots, and made a futile attempt at breakfast. The dangers of the darkness had disappeared; but the pleasure and excitement had gone too, and it was a right dreary walk that morning to the *Æggisch-horn*. The *Aletsch* glacier is intersected by a number of little crevasses, just too broad to step, and wide enough to tire weary men. As we walked on down its broad monotonous surface, I was surprised to find how extremely ugly everything looked. It was a beautiful day, and before us, as we approached the *Märjelen See*, rose one of the loveliest of Alpine views,—the *Matterhorn* flanked by the noble pyramids of the *Mischabel* and *Weisshorn*. I looked at it with utter indifference, and thought what I should order for breakfast. Bodily fatigue and appreciation of natural scenery are simply incompatible. We somehow contrived to split into three parties, and the rapidity with which we lost

sight of each other was a curious proof of the vast size of the glacier. A party of our friends passed us on their way from the *Æggisch-horn* to the *Col de la Jungfrau*, but we failed to see them. The utter insignificance of a human figure on these wastes of ice is one of the first things by which we learn to appreciate their vast size.

Lauener and I found our way to some *châlets*, where a draught of warm milk was truly refreshing. I need hardly say that after it we managed to lose our way over the abominable slopes of the *Æggisch-horn*. Shoulder after shoulder of that dreary mountain came out in endless succession, and I was glad enough to see the friendly little white house a little before 9 o'clock, and to rejoin my friends over a luxurious breakfast provided by its admirable landlord.

I have only to add that the height of the pass we thus made is, according to the Swiss survey, 12,290 feet. There are two over the same chain which deserve the attention of Alpine travellers. One is described by Professor Tyndall under the name of *Lauwinen Thor*, in "*Vacation Tourists*," and it must be a very noble pass. The other is the *Col de la Jungfrau*, which has not yet been crossed, though I hope at some future time to see it added to the list of the vanquished.

3. ASCENT OF THE ALETSCHHORN.

By F. F. TUCKETT, F.R.G.S.

THE year 1859 will long be remembered by mountaineers as one of the finest which has for some time favoured their explorations, forming, in this respect, a marked contrast to its successor. From the commencement of July till towards the end of September, an almost uninterrupted succession of brilliant days and cloudless skies offered the greatest inducements and facilities to the whole tribe of climbers, and many a peak, pass, and glacier, which had never felt the foot of man, then, for the first time, acknowledged his supremacy.

So uniformly fine was the weather, that one began at length almost to long for a cloudy day, by way of variety, whilst, from the incessant melting action of the sun, the mountains became rapidly so denuded of snow as to be quite marred in their beauty, and present a grim and uncouth appearance.

Indeed it may well be questioned whether, on the whole, variable weather be not the most conducive to the full enjoyment of a mountain district. Disappointing as it is at the moment to have some cherished scheme interfered with,—to wake on the morning of a day chosen for the attack and discomfiture of some mountain giant, and to listen instead to the plashing rain-drops, or to watch the thickly-falling snow-flakes,—there are, on the other hand, many compensating advantages. Not to dwell on the

picturesque side of the question,—the marvellous effects of light and cloud, and the charm of variety and surprise, as one point after another is unveiled, and the rolling mists wreath themselves into a thousand fantastic forms,—an occasional wet day is often practically found to be a real, though perhaps at the time an unwelcome, boon.

When once the mountain spell has done its work upon a man, the climbing rage—“*der reiz*,” as even the cautious Germans phrase it—so takes possession of him that it is difficult to restrain within reasonable limits the ardent desire to be up and doing, and, in the exaltation of the mind, the claims of the body would run no small risk of going unheeded, did not the much-abused bad weather come to the rescue.

What Goethe says becomes sooner or later true of mountaineering, as of art or science:—

“Vergebens werden ungebundene Geister,
Nach der Vollendung reiner Höhe streben.
In der Beschränkung zeigt sich erst der Meister;
Und das Gesetz nur kann uns Freiheit geben.”

“To mount aloft to heights serene
In vain uncurbed spirits try,
In self-restraint the master's seen;
And law alone can give us liberty.”

Mountains, like other good things, require a digestive process; and one can't go on swallowing them at the rate of two or three a week, with a liberal allowance of cols by way of seasoning, without at length becoming aware of a dulling influence upon body and mind, which renders the former more susceptible to fatigue, and the latter less alive to the charms of scenery.

A wet day, in short, like a full stop in a paragraph, gives time for breathing and reflection, and enables one to start again with renewed vigour. The botanist has an opportunity of drying and arranging his specimens,—making

hay, as some may perhaps wickedly insinuate, even when the sun shines not; the geologist's bulging pockets stand a chance of being relieved of their angular contents; the meteorologist finds time to reduce or verify his observations; sketches are touched up, home letters written, novel and remarkable tailoring feats accomplished, the trusty boots cobbled and re-nailed for the *n*th time; and the lost day proves, in fact, to be a great gain in many ways.

It is a very generally entertained opinion that the months of August and September are those best adapted for the *grandes courses* which have so multiplied of late years. In this there is much truth, though it depends partly, I believe, on custom, and also on the fact that those months being generally set apart for the holidays, a greater number of adventurous spirits are abroad at that particular time. Without going further into the question here, suffice it to say that, having for several years been in the habit of making pedestrian tours in Switzerland, and generally during June and July, I have never been prevented, except from temporary causes, from crossing the loftiest cols even in the early part of the former month, and have only occasionally found the higher summits inaccessible, either from the backwardness of the season, or from some other exceptional cause. Let none, therefore, whose engagements prevent their leaving home except at this time, be discouraged by a fear that they will be unable to do good mountaineering work. My experience goes to prove the contrary; whilst an early start affords other, and by no means trifling, advantages, such as the choice of guides, longer daylight, better accommodation at inns, a richer flora, grander expanses of snow, well-bridged crevasses, and unopened "bergschrunds."

Between 3 and 4 A.M., on the 15th June, 1859, ac-

accompanied by Victor Tairraz of Chamounix, and Peter Bohren of Grindelwald, I quitted Viesch for the Hotel de la Jungfrau, 7153 feet above the sea, and now so well known to tourists that it is hardly necessary to say one word in its praise. M. Alexandre Wellig, and his brother Franz, are model hosts, and the house is one of the best specimens of a mountain inn to be met with in Switzerland. Many a day have I spent beneath its hospitable roof, and, whether alone or with a merry party round the blazing fire, in rain or sunshine, I have ever found it "*valde bene in omnibus*." I will only add, that on the present occasion the house had been most kindly opened before the usual time entirely for my benefit; and though, on bidding him good-bye, M. Wellig insisted that I had not "*recu*," but only "*existé*," I can bear willing testimony to the resources of the *cuisine* and the excellence of the *cave*.

As we zigzagged up through the noble pine-woods which clothe the lower slopes, the sun rose in a cloudless sky, lighting up the deep red trunks till they glowed again, and giving promise of a brilliant day, which was in no way belied. Halting at the hotel for breakfast, we proceeded at 6.35 to ascend the Æggischhorn. This is usually an easy walk of an hour and a half, but the snow now lay low, so that our progress was delayed, and it was not till 8.30 that we gained the summit. The grand panorama was displayed in perfection, every peak standing out with the most brilliant clearness; and many very tedious pages might be filled with an enumeration of the mountain legion, that in serried ranks barred the horizon in every direction. Topography is dull, however, except to the initiated; and as those already familiar with the district require no explanation, and those unacquainted with it would not, I fear, be much the wiser for one, I will



THE ALETSCHEHORN, FROM THE EGISCHHORN.

confine myself simply to such particulars as are necessary to indicate the position of the Aletschhorn.

Standing, then, on the summit of the Æggischhorn, the vast mass of the Aletsch glacier is seen in all its vast extent from its central source in the snows of the Jungfrau, Mönch, and Viescherhörner, to its termination between the Lusen and Rieder Alps, a distance of about fifteen miles. Its course resembles a boomerang in shape, the Æggischhorn and Märjelen See being situated at the centre of the convex side, just where its downward direction changes from nearly south to south-west. On the opposite side of the glacier, to the north-west of the spectator, and at the head of the Aren or Mittler-Aletsch glacier, which here enters the main trunk stream at right-angles, rises the Aletschhorn, flanked by the subordinate summits of the Dreieckhörner, Olmenhorn, and others. On the north it is bounded by a great arm or feeder of the Aletsch glacier, which, descending from the Lötschsattel, and fed by the névés of the Mittaghorn, Ebnefluh, and Gletscherhorn, unites with the central stream from the Jungfrau and Mönch at a point nearly opposite the Faulberg. Its position is thus extremely central with reference to the great *massif* of the Oberland mountains, and on this account I think it is even superior as a point of view to the Finsteraarhorn, which overtops it very slightly.*

I had come to this place with no very definite idea of what excursions I should make; but before quitting the

* The following are the heights of those peaks of the Oberland group which exceed 13,000 English feet in height, as given on the Federal map, or in the works of Durheim and Ziegler: —

1. Finsteraarhorn . . .	14,026	6. Walcherhörner . . .	13,281
2. Aletschhorn . . .	13,803	7. Gletscherhorn . . .	13,064
3. Jungfrau . . .	13,671	8. Eiger . . .	13,045
4. Mönch . . .	13,438	9. Ebnefluh . . .	13,005
5. Schreckhorn . . .	13,394		

summit of the *Æggischhorn*, my mind was quite made up that, weather permitting, the *Aletschhorn* should be the first point of attack. I threw out a hint to Victor, who at first shook his head, and said there was too much snow, but gradually caught my enthusiasm, and ended by pronouncing it "*bonne idée*," in which Peter Bohren, always ready for anything in the shape of scrambling or adventure, strongly coincided. And so it gradually became a settled thing that we should at least make the attempt.

The beautiful *Märjelen See* at our feet was almost entirely frozen over and snow-clad, with the exception of a canal of blue water on the further side, in which floated some miniature bergs. Here, on our first arrival at the summit of the *Horn*, we were witnesses of a very pretty and interesting spectacle. Two chamois, which were grazing on the rocky slopes beneath us, took fright on discovering our presence, and, descending rapidly to the margin of the lake, started off across its frozen surface towards the base of the *Strahlhörner*. Through my telescope I could watch every movement of the graceful creatures, who were evidently in no small perplexity. The ice proved thin and treacherous, and every now and then the leader would pause in great embarrassment, look around, then strike off again more to the left or right, once more to be brought to a stand after fresh flounderings and lettings in. They seemed to be ignorant of the canal of open water, which might be some thirty feet in width, completely cutting them off from the shore; and I watched with great curiosity to see what they would do on discovering the trap into which they had fallen. The doubt was soon solved. The leader, on reaching the water's edge, trotted along it for some distance till he came opposite one of the floating bergs of small size, when he made a magnificent

leap, landing safely on the little islet of ice, which spun round with the impetus, and gained the land in a second bound. His companion, a female, following his example, reached the berg in safety, but failed in the second leap, and fell into the water. She soon, however, scrambled out, and the two made off together up the steep mountain-side at a pace that excited my admiration and envy.

After spending two delightful hours at this charming spot I read off my barometer, and we then descended to the Aletsch glacier, followed its course till opposite the Aletsch Wald, and then climbing the south slopes, and crossing the ridge a little to the north of the Rieder Alp, made our way back by the Betten and Laaxer Alps to our hotel.

It was amusing to watch Wellig's puzzled look when I told him of the meditated expedition. Every discovery of an additional excursion is an advantage to the hotel-keeper; but then, "it was so early in the season that he hardly felt justified in encouraging me." I thanked him, said that my mind was quite made up, and that I would take the entire responsibility on myself, leaving him to find the necessary provisions. He still seemed to hesitate, fearing that if anything went wrong he should be blamed, but at length consented to facilitate my views, provided I would give him a written statement, that he had fairly represented the case to me, and that I had relieved him from all responsibility. All this sounded very absurd; but considering that such expeditions are rarely taken at so early a period as the middle of June, and that, had anything gone wrong, he might have suffered in reputation, I at once complied with his request.

The following day a messenger was despatched to Laax for the trusty Bennen, then a servant of the hotel, but now an independent guide on his own account; and as Bohren's boots wanted cobbling and he had no gaiters, he

descended to Viesch, whilst I strolled away with Victor along the well-known watercourse towards the glacier of Viesch and the Märjelen Alp. After scrambling about for some hours, we descried a cosy nook in full view of the wildly-contorted ice-stream which struggled down through the rocky gorge at a great depth below us, and here, for three hours, we established ourselves in a state of lazy enjoyment, which past labours and the prospect of future hard work could alone justify. I would call the attention of travellers to the very beautifully formed and clearly defined ancient moraine of the Viesch glacier, — or perhaps, I should say, of the united glaciers of Viesch and Aletsch,—which may be seen from the neighbourhood of the hotel, and was very conspicuous from our resting-place. From a point rather below the present termination of the glacier, and on the east side of the valley, it sweeps round in a most graceful curve, overlapping at its southern extremity the village of Viesch, and clothed with pines, which thin off as the glacier is approached. Its true character is seen at a glance when once the eye catches its outline, whilst the recently constructed road leading to the upper Vallais, which zigzags up its terminal slope, offers several sections, disclosing the boulders and sand of which it is composed.

On our return to the hotel we found that Bennen had arrived. His appearance at once impressed me most favourably, and I liked him none the less when he eagerly entered into my views, and pronounced the ascent of the Aletschhorn "*ohne Zweifel schwierig, doch möglich*" (doubtless difficult, but yet possible). There was a frank hearty look about him, an honesty in the eye, and a quietness and simplicity of manner, which proved on this, as well as on many subsequent occasions, a true index of his character. I most cordially unite in the warm

eulogium passed on him by Professor Tyndall, as well as in the more recent allusion to him by Mr. Hawkins in the graphic narrative of his and Professor Tyndall's attack on the Matterhorn.

The afternoon proved stormy, snow and rain fell in considerable quantities, and a falling barometer rendered my hopes for the morrow somewhat of the faintest. Appearances, however, improved after nightfall, and under M. Wellig's active superintendence, with numerous solemn consultations in the kitchen, at which everybody assisted, the necessary preparations progressed steadily. The great tin can, familiar to *habitués* of the Hotel de la Jungfrau, carried like a knapsack, and holding an indefinite number of bottles, was produced and nearly filled with good, sound *vin du pays*,—not for want of anything better, but because there is much truth in Bennen's remark that "*es schmeckt ganz gleich dort oben*") it's all one up aloft). A bottle or two of champagne was added, by way of enabling me to study the expansion of gaseous bodies under a diminished atmospheric pressure—of course, for no other purpose. As for solids, it need not here be told how poulet and ham, sausage and mutton, bread, cheese, butter, and honey, with other good things galore, were duly consigned to a roomy "*Hutte*" or basket, nor how "*noch ein stück*" of this, that, and the other was added to fill up crannies, till all were satisfied that there was no danger of a deficiency. There being no known resting-place, such as the Faulberg offers in ascents of the Finsteraarhorn, Jungfrau, &c., it was thought desirable to take a couple of coarse blankets, together with a small supply of fire-wood; and then it was discovered that an additional pair of legs would be required to carry the mass of indispensables and luxuries we had by this time accumulated. Being in a particularly good humour, having a

special dislike to bargaining, and taking into account the amount of additional fatigue caused by the deep fresh snow, I gave way, perhaps somewhat too readily, and the consequence was that we had the company of a strong, stolid individual, Alexander Bürker by name. He appeared to be all back *et preterea nihil*, a peculiarity which served our turn better than if there had been more talk and less do in his composition.

On rising at 5 in the morning of the 17th, I found a dense fog concealing everything from view, and weather-wiser heads than mine shook ominously. The temperature had, however, fallen considerably; and knowing that after the rain of the previous afternoon a fog might be expected at this early hour, without being necessarily an unfavourable indication, I had no idea of giving up, or even delaying the expedition. Fortifying myself, therefore, with a hearty breakfast, I descended to the guides' apartment to superintend the final packing and adjustment of the loads. It is well always to see to these things oneself, and to obtain from the landlord a list of provisions, by which to check off each article as it is packed. By this means the not uncommon accident of leaving behind the salt, or sugar, or cups, or some other equally important article, is avoided.

At length after much palaver, oft-repeated good wishes from our host, little speechifyings, and various other manœuvres, of which a quiet Englishman bent on quietly accomplishing his work rarely sees the meaning or advantage, we got under weigh about 7. Our party consisted of Victor Tairraz, Peter Bohren, Joseph Bennen, the man with a back, and myself, two more than were necessary; but, as I before mentioned, I was in a compliant humour, and for once let things take their course.

The mists showed some signs of dispersing, though the

appearance of the weather still continued anything but assuring, and grand masses of brouillard rolled over towards us from the other side of the Rhone valley, occasionally disclosing the mountain summits, deeply covered with fresh snow,—a sight which boded ill for our success on the morrow. Pushing forward at a steady pace, we reached at 8.30 a sort of depression or col, to the west of the *Æggischhorn*, after a long pull through soft snow. Here the Aletsch glacier came into view, but the opposite mountains were still entirely concealed. A steep descent down slopes of snow and rock brought us to the lateral moraine at 9.30; and as we had the day before us, and the cool morning air had sharpened our appetites, it was decided that a glass of wine and something to eat would be no bad idea. At 9.45 we were again *en route*, and taking to the ice struck across diagonally for the west side of the *Aren* or *Mittler-Aletsch* glacier, at the point where it sweeps round the base of the *Sattelhorn* and unites with the trunk stream. This direction, though it involved a slight detour, was selected in preference to the east or *Olmenhorn* bank, as the ice-fall in which the glacier terminates seemed on that side to present greater difficulties.

It has been asserted that the Aletsch glacier exhibits no medial moraine; but this, as far as relates to the lower half of its course, is a mistake, which may have arisen from the circumstance, that the spectator stood at the side of, instead of facing, its mass. In the former position the bands, which are not so strikingly developed as on the *Unteraar* and other glaciers, might almost escape notice. When seen, however, from the *Lusgen Alp*, or the *Furka*, above the *Rieder Alp*, which command a view directly up the portion of the ice-stream extending from the pine-clad gorge beneath to a point a mile or more above the

Æggischhorn, three, if not four, well-defined, perfectly parallel medial moraines are clearly distinguishable. They are separated by very narrow intervals, and are very unequal in magnitude. I have never been able to trace them clearly to their origin, but am inclined to think that one or more is derived from the Walliser Viescherhörner, whilst the others may have a more distant source, but, ingulfed in the *névé*, only come to light in the central and lower portion of the glacier. A photograph by Martens, taken from the Lusgen Alp, gives an admirable idea of these moraines, and of the course of the glacier as far as the Faulberg. I could see no dirt-bands nor regular swellings of the surface; but the "ribbon structure" was beautifully developed, and its relation to the lines of pressure and the direction of the crevasses unmistakably clear.

The passage of the glacier occupied about an hour, numerous *détours* being necessary in the more crevassed portions. After crossing the lateral moraine, formed by the union of the *débris* of the east and west slopes of the Olmenhorn and Dreieckhörner, which here cover a considerable surface, being spread out by the forward thrust of the Aren glacier, we reached at 10.45 the base of the Sattelhorn. Here a halt was called before commencing the ascent of the "*seracs*" to the upper level of the glacier, as a storm of snow and hail appeared to be sweeping down it, and our present position offered better shelter than was to be obtained higher up. A keen cutting wind now rushed down upon us in furious gusts, whirling angular fragments of hail, mixed with snow, in our faces; and the thought would now and then intrude that a night on the ice, under such circumstances, might be a dubious pleasure. Gradually, however, the storm drew off down the gorge of the Massa, and soon after 11 the foot of the ice-fall was reached, and a steep snow-

slope ascended for half an hour, till a jutting rock was found, which tempted us to camp and lunch. As the loving cup went round, and the sky brightened, the spirits of all rose, and even the placid porter gave vent to his pent-up feelings in sundry "*jauchsen*" and "*jödeln*," which woke up a magnificent echo in the cliffs above.

At 12.30 the word of command, "*vorwärts*," was shouted by Bennen, and a short stiff scramble over and between the jagged masses of the dislocated glacier brought us to its central portion. As this was entirely covered with snow, and signs of crevasses abounded, the rope was put in requisition, and in single file we tramped steadily forward in a north-west direction, crossing the glacier diagonally towards the Dreieckhörner, and making for the western base of the Olmenhorn, in the hope of discovering some suitable place for the night's bivouac.

For a long time our search proved fruitless, nothing in the shape of shelter presenting itself with the exception of a large isolated erratic block, resting upon the ice of the glacier, and which would have been only better than nothing, if we could have been certain that the wind would not shift during the night. Before, however, forming ourselves into an improvement and building committee, it was resolved to make a further examination of the rocky sides of the Olmenhorn, and Bennen's quick eye having detected a promising-looking cranny at a considerable height, he was despatched, about 2 o'clock, to make a closer investigation and report the result. This was speedily communicated to us, in what was supposed to be a favourable sense, by loud shoutings and hunting calls, and a climb of some 300 feet, soon enabled us to judge for ourselves of the discovery which had rewarded our perseverance. This was a cleft of no great width or depth,

which, with the help of a little engineering, promised to be quite a palace compared with anything we had ventured to hope for.

The first operation was to level the floor, which had a disagreeable slope, and this was soon accomplished with the aid of some flat stones, a good supply of which was at hand. Under these, a channel was scientifically constructed for the water of a little spring which welled out from the back of the cave, and proved a very convenient source of supply for our subsequent culinary operations. Leaving Victor and the porter to complete the "*travaux de construction*," Bennen, Bohren, and I started on a hay-making expedition, which proved eminently successful, and after a pleasant scramble returned, heavily laden, with a supply of dry grass, which, duly disposed upon our stony platform, made quite a luxurious couch. Our cave was evidently a favourite resort of chamois, to judge from the quantity of hair and numerous bones that lay scattered about.

Our arrangements for the night being at length completed, we began to think about dinner; so, lighting my Russian furnace*, a "*casserole*" of water was boiling merrily in less than five minutes, and a cake of Chollet's "*Julienne au gras*" being sliced into it, we were soon busily engaged upon a couple of quarts of really excellent soup and vegetables, as a first course, followed by *pièces de résistance* and *entremets* in the shape of mutton, veal, ham, and sausage. The soup, both from the manner of its production and intrinsic excellence, seemed to make a profound impression on my companions, who had, I suspect, previously imagined the brown-looking cakes out of which vegetables seemed to spring into existence, like

* See Note 1 at end of this Article.

flowers from a conjuror's hat, to be "*der Herr's*" supply of cavendish. Many an exclamation of surprise—" *Sehen Sie nur! wie es ist merkwürdig!*" &c.—"Just look! how wonderful!"—rose around me, as the process of conversion went on, and Bohren especially could not for a long time get the "*vortreffliche Suppe*" out of his head, as the sequel will show.

Dinner over, whilst Victor, who is an universal genius, washed up, Bennen smoked his pipe, and I made some meteorological observations.* Bohren, who never seemed to be so happy or comfortable as when poking about amongst the rocks and into all manner of holes and corners, disappeared with Bürker over the edge of the cliff, and soon a perfect storm of rolling stones, accompanied by vigorous strokes of the axe, gave signs of his never-ceasing activity. In half an hour he returned, with a flush of triumph on his good-humoured face, and informed us he had manufactured for himself a magnificent "*gîte*," which he begged me to come and see.

From the entrance of our cave the cliff fell away almost perpendicularly for a depth of eight or ten feet, to a little platform, which afforded a secure landing-place; from this the level of the glacier was easily attained, by traversing a narrow ledge along the face of a precipitous rock, and scrambling down slopes, intersected by couloirs of débris or snow. Near the middle of the ledge, the rock receded or caved in for a length of four or five feet; the recess extending back to a depth of about three feet, with a floor sloping inwards. On descending to this spot I found that Peter, ingeniously availing himself of the cranny, had improved upon it by ranging flat stones edgewise upon the ledge and along the opening, plugging the

* These give for our cave a height of 8896 English feet (mean of Geneva and St. Bernard).

interstices with moss, and strewing the interior liberally with hay, leaving a hole at one end just large enough to wriggle his body through, feet foremost. In this way he had produced no bad imitation of a caddis-worm's cell; and when inside, with nothing of him visible but his face, the general effect was not unlike that of a magnified Indian papoose. His performance drew down "thunders of applause," which speedily added Victor and Bennen to the circle of admirers; and Peter, seeing how sincere my praise was, most politely insisted that I should occupy the cell. I at first declined; but as he persisted, and the place really took my fancy amazingly, I gratefully accepted his handsome offer, though not without some scruples, such as a conscientious hermit crab might entertain before turning a polite whelk out of his shell.

The temptation was all the greater, for, in proportion as the prospects of the weather improved, the air became colder, and a keen northern blast would at times insinuate itself into our cavern, with an amount of cold-bloodedness that suggested uncomfortable wakings during the night, and undesirable shiverings down the back, in spite of all one might do to keep the intruder out, and notwithstanding a Scotch plaid stretched across the entrance. Already, indeed, we were so cool, not to say chilly, that we decided unanimously on a good scramble over the rocks of the Olmenhorn,—a description of exercise which, except where "*mauvais pas*" necessitate caution and deliberation, is about as warming as any that can be selected. An hour of this work sent us back all in a glow to our snuggery, where we determined thoroughly to enjoy ourselves, till it was time to turn in. My "*machine*" was accordingly again put in requisition, some piping-hot grog was brewed, pipes were lit, and, as the smoke curled cheerily out into the evening air, it would not have been easy, I fancy, to

find a merrier or happier party at any comfortable English fireside.

Conversation at length flagged, and, knowing that cold is much more felt when one is silent, and thinks about nerves, and sensations, and other abstractions, which ought not to be admitted for a moment into the mountaineer's vocabulary, I soon, in order to start the others, volunteered a song. Solo and chorus followed in quick succession, till the roof rang again with polyglot harmony, in which the ingredients contributed by my companions consisted, for the most part, of pathetic allusions to "Vaterland," unknown "Mädchen," and impossible "Gemsens." Lest any one should be disposed to think that the "*machine*" or its contents had anything to do with these ditties, I beg to observe that my brew was of the mildest, and the allowance sternly homœopathic: I always find that the most limited use of spirits, or, still better, entire abstinence, is to be recommended to the pedestrian, especially when liable to be exposed to long-continued cold or wet.

Soon after 9 P.M., a rope having been first tied round my waist as a precaution whilst descending the cliff in the dark, I betook myself to my hole, some thirty or forty feet lower down, drew a woollen nightcap over my ears,—I had previously donned a second shirt and pair of flannel trowsers,—rolled myself snugly in one of our "*couvertures*,"—a coarse sort of counterpane,—and was then built in with stones,—a large one forming the door, and only small crannies left for the admission of air. At first I thought I should be smothered; but as the night wore on, the cold increased to a great degree, and, on rousing partially two or three times, I was glad to draw my wraps still more closely around me, and pile the hay upon my feet.

I had scarcely settled when Peter commenced a series of songs, or one long epic—I don't know which,—and this,

with the occasional assistance of Bennen, he contrived to keep up with scarcely a moment's cessation till past midnight, as Victor, who wished to get some rest, and was excessively disgusted at having to listen to what he did not understand, afterwards informed me. I do not wish to be uncharitable, but (by way of parenthesis) I may remark that our stores comprised a bottle of "*rhum*," in case of need, which bottle is supposed to have slept near Bohren, and to have passed a very restless night, as its contents had partially evaporated before morning. I think the delinquent suggested, in reply to my remonstrances, that the cold might have had something to do with it, and I remember reading him a severe lecture on his folly, which ended in a little quarrel and ultimate reconciliation.

At 12.30 A.M., June 18th, after getting three hours of tolerably unbroken sleep,—an art in which I flatter myself I am a proficient,—I arose from my lair. Brilliant moonlight was penetrating through my breathing-holes, and a slight push at once sent the door of my apartment bounding down the rocks beneath, at the same time letting in such an amount of cold air as speedily removed the slightest inducement to prolong my slumbers. A vigorous crow, two or three times repeated, brought Bennen in hot haste to my rescue, and his strong arm soon extracted me, somewhat after the fashion of a periwinkle, minus the inevitable pin, and in a semi-fossilised condition, from my rocky chamber.

I shall not soon forget that crawling forth into the intensely keen but perfectly still night air. Glorious moonlight streamed up the glacier at my feet, whilst each rocky peak and snowy ridge, bathed in soft, subdued light, had an almost unearthly beauty, suggestive of scenic change or magic transformation. Our mountain, the

Aletschhorn, rose proudly at the head of the valley, not even a wreath of mist clinging to its vast buttresses, and with an apparent calm, quiet consciousness of its own superiority,—a sort of now-then-come-on look about it,—that raised a responsive defiance in the heart, and made me long to be up and away, pitching into its icy ribs with alpenstock and axe.

On reaching the cave I found Bohren's tide of melody still flowing, and, as interference at the moment would have been utterly useless, I left him for a time to himself. When Victor and I had brewed some famous hot tea, he — doubtless retaining an agreeable reminiscence of the previous day's *Julienne* — insisted that our concoction was soup, and "*recht gut*" too, and proceeded deliberately to consume the leaves, an undesirable proceeding, against which I remonstrated with some success. Knowing how important it is on such occasions to make a good meal before starting, especially when, as in the present instance, the cold is extreme, Victor and I secured a substantial breakfast, and tried to induce the others to do the same. Bohren, however, was in far too exalted a state to listen to reason, Bennen had no inclination for food, and Bürker preferred taking out the time in sleep. The result later in the day was just what I had anticipated,—Bürker knocked up in a very short time, Bohren was generally indisposed, and at the foot of the final ascent declared he could go no further, whilst Bennen suffered greatly from difficulty in breathing, and neither of them was quite right till the following day. Victor and I, on the contrary, were in excellent condition, and did not experience the slightest inconvenience.

A moderate but sufficient supply of provisions and a bottle of champagne were consigned to a knapsack, the wine-can strapped on the porter's shoulders, and, all

being at length ready for the start, we quitted our temporary home at 2.30 A.M., scrambled cautiously down to the glacier, and were delighted to find the snow in excellent order, the keen frost having rendered it almost as solid as rock. Favoured by this circumstance, as well as by the bright moonlight, we made rapid progress, and at 3 reached the head of the glacier, whence steep slopes of *névé*, intersected by numerous crevasses, led up to a sort of col or depression, the lowest point of a snowy *arête* connecting the Aletschhorn with the Dreieckhörner.

About this time I observed a phenomenon of rather rare occurrence, but which now presented itself on such a scale, and with such intensity, that I may be permitted something more than a mere passing reference to it. I allude to a "phosphorescence" of the snow, of which the MM. Schlagintweit remark*—"Snow and ice, especially large lumps of the latter, become slightly, but quite distinctly, phosphorescent when brought into a dark room, after being exposed to the light at a temperature several degrees below the freezing point." These gentlemen, however, seem to have witnessed the appearance only from a distance, and when the luminous surface was projected against the sky, whilst in the present instance we were completely surrounded by it. The glacier valley we were traversing, the entire mass of the Aletschhorn, and the snowy *arêtes* and slopes connecting it, on the one hand, with the Dreieckhörner, and on the other with the Rothhorn, shone with a soft lambent glow, something like that produced by the flame of naphtha, and reminding me strongly of the well-known "*Grotta azzurra*" at Capri, though less decidedly blue in colour. It might have been

* "Neue Untersuchungen über die Physicalische Geographie und die Geologie der Alpen," von Adolph und Hermann Schlagintweit, page 480. Leipzig, 1851. See also Note 2 at the end of this paper.

the opening scene in some act of incantation, so weird and unearthly was the effect, and my companions seemed to entertain the notion that it was not altogether "canny." Happening to look down, a new surprise awaited me. At every step we took an illuminated circle or nimbus, about two inches in breadth, surrounded our feet, and we seemed to be ploughing our way through fields of light, and raising clods of it, if I may be allowed the expression, in our progress. I was inclined at first to attribute this effect to the action of the moon's rays, as they fell obliquely upon the small cloud of fine snowy particles raised by the movement of our feet; and I still feel some little uncertainty on this point. Of the character of the general phenomenon, however, no doubt could exist, as its intensity increased when the moon sank behind the Rothhorn, and the sides of that mountain, now in deep shadow, presented the appearance of a transparency, as they shone with the subdued brilliancy of a glacier vault or "*bergschrand*."

On the lower portion of the ascent before us, the névé was much crevassed, and, as the fissures were dangerously masked by the fresh snow, some caution and many détours were required to effect a passage. Once, however, clear of the maze, steep slopes of solid snow alone separated us from the col; and as, at 4 A.M., the thermometer indicated a temperature of only -7° Centigrade (19° Fahrenheit), a rapid pace was both easy and agreeable.

The pale tints of dawn had been stealing over the summit of the Aletschhorn for nearly an hour, when, at 4.15, the ruddy hues of sunrise struck the topmost peak, and soon the mountain was all aglow in a blaze of splendour which I have never seen surpassed in magnificence. Almost at the moment of lighting up, a soft fleecy cloud seemed to spring into being close to the surface of the

Aren glacier behind us. An instant before all had been clear, and now there was the misty veil, which "rose like an exhalation," and gradually faded away as the sun gained power. The vapour was probably then in a state of invisible suspension, and its sudden appearance must have depended on some effect of oblique illumination, which often produces most striking, and, at first, almost incomprehensible effects. Throughout the day, with the exception of this passing visitor, not a cloud, nor even the faintest wreath of mist, dimmed the dark-blue vault above us, and the vast horizon of mountain chains.

At 4.30 the thermometer indicated -9.5° C., or 15° F., and only rose to -8° C. in my pocket; but the air was still, and our rapid progress up the steep slopes set us all in a glow. There were decided symptoms, however, of a very different state of things on the ridge in our front. Clouds of fine snow were whirling into the air like smoke, — a sign equally unmistakable and unwelcome that a furious "*vent du Nord*" was vexing the upper world with its keen blast. It required, therefore, but little logic or acuteness to show that our endurance would be put to a pretty severe test ere the goal should be won and our present sheltered position regained.

At 5.15 the col was reached: there was a sudden glimpse into a new world, a wild sea of peaks,—Jungfrau and Mönch, Gletscherhorn and Ebnefluh,—and then, phiz—z! right in our faces came a blast of such keenness, and charged with such a storm of icy spicula, that it sent us reeling backwards, eyes, ears, mouth, and nose filled with the fine frozen particles which insinuated themselves into everything. Our worthy porter, who had got thus far in safety and silence, now announced that he was knocked up, and was accordingly relieved of his tin, fed, and dismissed, to find his way back at his leisure to the cave,

and there await our return. We likewise retraced our steps a few paces till below the line of fire, and made a second breakfast of bread, meat, cheese, and champagne, partly on the principle that —

“He that would fortify the mind,
Must first the body fill” —

and partly because, by this time, cold and exercise had not a little sharpened our appetites. While seated here, the sun peeped over the ridge between the Olmenhorn and Dreieckhörner, and looked comfortable, if it did not warm us much; for the thermometer had now got down to -10° C., or 14° F., and certain sensations in outlying portions of the body warned us that a long stay would be undesirable.

So, at 5.45 A.M. we again addressed ourselves to our task, leaving the commissariat in the safe custody of a snow-drift.

A nearly level ridge or arête of snow, some two hundred yards in length, and running up to a thin edge, extended south-westwards from the point we had reached, sinking again into a second slight depression, beyond which rose the upper portion of the Aletschhorn, with its double summit. On both sides the arête fell away in extremely precipitous slopes of snow and névé, which terminated to the south in the Aren glacier, and on the north in that upper branch of the Aletsch glacier which has been already referred to as descending from the Lötschsattel. The wind and snow had formed on this latter side a “*corniche*” or eave, and it was therefore necessary to traverse the length of the ridge a little below its summit, by which means we were also partially protected from the chilling northern blast. This was the most doubtful part of the whole expedition, as the southern

slope, rapid enough at first, descended at a constantly increasing angle, and became all but perpendicular as it approached the glacier beneath; whilst "there was nothing to arrest a falling body in its fearful plunge" of 2000 feet. A good head, however, care in roping, and caution in placing the feet, will in all such cases reduce the risk to a minimum. The real danger lay in the fresh snow which our united weight might set in motion, thus producing an avalanche, against which, in such a position, nothing but the utmost coolness and the promptest action could, as we had soon occasion to prove, avail anything.

Here, however, the frost came to our aid, binding the snow in its icy grasp, and giving us confidence in the security of our footing, though what effect the sun might produce in the interval that must elapse before our return, was a question which, as it involved an unpleasant doubt, was dismissed from our minds. The axe was now brought into requisition for the first time, Bennen and Victor taking turns at step-cutting, as Bohren was suffering from the cold; and with scarcely a halt we worked steadily forward, reaching at the end of three-quarters of an hour, or at 6.30, the second col or depression, which was the limit of the arête in this direction. The more rapid portion of the ascent now commenced; and as we wound up and round the slopes of the lower and more easterly summit, the wind, being in our backs, rather assisted our progress, though its attentions were still more boisterous than pleasant. Showers of fine snowy particles were hurled, as if in spite, against every weak point in our defences, and our back hair was soon a mere mass of bobbing icicles.

About 7 we reached a bergschrund, a species of crevasse usually met with at the base of the higher and steeper slopes, and probably produced by the lower snow-

fields giving way. These often present serious obstacles, especially at a later period of the year, when they attain their maximum development, and the bridges of snow, which in June and July offer a safe mode of transit, are altogether melted, or become so attenuated as to afford but a treacherous support. In the present instance, however, we managed to turn the enemy; and passing soon afterwards, in a similar way, round some awkward crevasses in the névé, exquisitely fringed with enormous icicles, we found ourselves in a sort of hollow between the two summits, the lower of which, a rounded dome, rose on the right some one to two hundred feet above us, whilst the higher shot up steeply before us to a much greater elevation. From this last we were still separated by a second bergschrund, which there was no avoiding, as it swept completely round the foot of the final ascent. The passage was soon effected, however, without much difficulty, and at 8 o'clock the first step was cut in the frozen slope, which rose steeply from its margin.

The snow, covered with an icy "*croûte*," lay at an angle of 50° ; and as every step had to be cut, we made but slow progress, and were necessarily much exposed to the blast, which could now batter us to its heart's content. Constant movement of both feet and hands was requisite to prevent frost-bites, and more than once I heard poor Peter piteously exclaiming, "*Ich kann nichts mehr; ich muss sterben wenn ich nicht zurück gehe*" ("I can do no more; I must die if I don't go back"). As, however, I knew that, as long as he kept moving, there was little or no danger of his coming to any harm, and he had besides brought his sufferings on himself entirely by his thoughtlessness, my sympathies were not very strongly excited or freely expressed, and I dare say I appeared in a most unamiable light. Gradually the mass above us tapered

away more and more, and at length, after a stiff climb of three-quarters of an hour, and with the aid of rather more than two hundred steps, we stood upon the summit exactly at 8.45 A.M. The effect was startling. A moment before, and nothing was visible but the snow-slope and the heels of the man in front, and now there was nothing above us but the sky, whilst all the world was at our feet.

The first thing to be done was to set up my barometer, in order that it might have as long a time as possible to settle. After an exposure of a quarter of an hour, the reading was 460.4 millimètres (reduced to 0° C); air temperature in shade, -12.2° C., or 10° F.; in sun, -6.7° C., or 20° F. This indicates, by comparison with Geneva and the St. Bernard, a height of 13,664 and 13,633 feet respectively, or a mean of 13,648, which is 155 feet less than that given by the Swiss engineers.

A wind of such violence as almost to carry one off one's legs, driving snow, and 22° (Fahr.) of frost, are not quite the companions one would select for the examination of so vast and diversified a panorama, and the "*cui bono*" argument may here appear to the uninitiated unanswerable. Scoffers may laugh and wise men shake their heads; but, in spite of them all, I unhesitatingly maintain that there is a joy in these measurings of strength with nature in her wildest moods, a quiet sense of work done, and success won in the teeth of opposition which, whether we owe it to our Anglo-Saxon blood, as some may hold, or whether it be only one of the modes in which the "contrariness" of human nature crops out in certain individuals, are nevertheless as genuine feelings as that which, at the witching hour of dinner, attracts unto his club the mildest, most comfortable, and least erratic old gentleman who "dwells at home at ease." Nay, could the

writer of the clever article in the *Times* on mountaineers and their pursuits, which set us all laughing some time ago, be induced to enter the lists against some doughty giant of the mountain-land, I should not despair of his being won over to the climber's view of the question.

To return, however, to myself and my companions, left shivering all this time on our snowy pedestal. I will frankly confess that my descriptive powers are totally unable to grapple with either the vast extent or thousand details of the wonderful view which stretched away endlessly in widening circles, till mountain and valley, earth and sky, were blended in the blue haze of distance. Even could I give to the component parts the most pictorial grouping, and place them before the reader in their all but endless succession, I fear that I should fall miserably short of conveying an adequate impression of the scene. Abandoning, therefore, the attempt to catalogue, let us see what can be done in the way of classification, by simply indicating some of the more prominent centres, around one or other of which the minor details group themselves. These are the mountains of the Oberland; the great plain of Switzerland, bounded by the Jura; the Bernina group, with the mountains of the Grisons and Tyrol; Monte Rosa and her allies, from Monte Leone on the east to Mont Vélán on the west; the *massif* of Mont Blanc; and far away, mellowed by distance*, yet defined with the utmost sharpness of outline, the rugged forms of the "*montagnes d'Oysans*," which, till the cession of

* The summits of the Aletschhorn and Grand Pelvoux are distant from one another about 135 miles, as the crow flies; and I do not recollect ever having been able to identify a mountain at a greater distance. It is popularly supposed that the Orteler Spitz is visible from Monte Rosa; but there are good reasons for believing this idea to be a myth, and, at any rate, the extent of vision implied is scarcely so great as in the case of the summits of Dauphiné.

Savoy, boasted, in the Mont Pelvoux, the loftiest summit in France. The intelligent reader will know how to clothe these colossal masses for himself in all their magic colouring and variety of form, and thus, like another Cuvier or Owen, build up from the disjointed framework here merely indicated, that goodly portion of our common mother which is embraced within its limits. My more modest task shall be confined to a few remarks on the first-mentioned group,—that of the Oberland,—of which the Aletschhorn itself is a distinguished member, as a glance sufficed to assure us.

With the exception of the rocky pyramid of the Finsteraarhorn, and the yet loftier summits of the *Pennines* and *Hautes Alpes*, we overtopped everything within the range of vision, though of our nearer neighbours the sharp peak of the Jungfrau appeared but little inferior in altitude. The great elevation of our position was perhaps most strikingly illustrated by the fact that, on the north, the eye ranged completely over the chain which extends from the Jungfrau to the Breithorn, and comprises the lofty summits of the Gletscherhorn, Ebnefluh, Mittaghorn, and Grosshorn, none of them less than 12,000 feet in height. There lay, stretched out before us till lost in the obscurity of distance, or bounded more distinctly in a N.W. direction by the range of the Jura, the great plain of Switzerland, over the surface of which hung a veil of mist, serving to remind us that a very different climate to ours was enjoyed by its inhabitants, whilst, at the same time, it rendered minute details undistinguishable.

Turning now to the opposite quarter of the compass, the eye followed the snake-like windings of the Simplon road,—the “*cantines*” dwarfed into the semblance of milestones,—bounded, on the one hand, by the heights of the Monte Leone, and on the other by the still more

imposing mass of the Fletschhorn. Away in the far south, the faint blue outline of more distant summits rose from out the haze of the Lombard plain, where the legions of France and Piedmont were then engaged in deadly strife with the hated "Tedeschi." The combats of Palestro and Montebello, the *mélée* of Magenta, the wild enthusiasm of recovered liberty at Milan, and the fierce fight of Melegnano, had now given place to that pause, which, like the lull that precedes the hurricane, preluded the hour when, from early dawn till the stormy close of a summer's day, the hostile ranks surged in fearful shock round the heights of Solferino. These reflections, if they did not occur to me at the time, doubtless ought to have done so; but I was unluckily in total ignorance of everything that had happened at the seat of war subsequent to Magenta, and so thought took a more prosaic form. It required, however, no great stretch of the imagination to picture what might be going on at the moment; and the consciousness that events which riveted the attention of Europe were then developing themselves behind that rocky barrier, and within the range of our vision, served at least to enhance the sense of vastness which, in the abstract, the mind almost fails to grasp. For the mere statement that a radius of 100 miles hardly defines the sphere of vision, suggests to most persons no very precise idea.

As already mentioned, the lower or eastern summit of the Aletschhorn consists of a rounded dome, which now lay some 600 or 800 feet beneath us, and was hardly distinguishable from the snow-fields out of which it rose. The highest point on which we stood consisted, at the time, of a nearly level and very narrow ridge of snow, extending in a N.E. and S.W. direction for a distance of 80 or 100 feet. In the centre and highest portion of this a small rocky patch was visible, enabling me to secure a souvenir

in the shape of the summit, which was at once transferred to my pocket. On the N. and E. the ground falls away very rapidly, but on the S. and W. snowy arêtes less precipitous, at any rate for the first few hundred yards, establish a connection with the Rothhorn, and the upper névé of the little known but very beautiful Jägi glacier. This last, lying between the Aletschhorn and Gross Nesthorn, and exhibiting some beautifully developed medial moraines, might be reached, probably without any great difficulty, by the Ober Aletsch glacier, which indeed is its southern outlet; and though I do not think the Aletschhorn itself could be attacked from this side with much chance of success, it must form a very imposing feature in the view. It might be possible to effect a passage in this direction into the valley of Lötsch, thus avoiding the long détour by the Lötschsattel (indeed this has, I believe, been already accomplished by the late M. Löhner, curé of Kippel), and I strongly recommend my brother mountaineers to direct their attention to the exploration of its recesses, believing that they will be amply rewarded by very fine scenery and some interesting topographical results.

We had been on the summit rather more than half an hour, of which I had made diligent use to fix in my mind, as far as possible, the greater features, at least, of the magnificent panorama; but, finding that Bennen's breath was much affected, whilst the dark blue appearance of his and Bohren's face, arising from the congestion of the minuter blood-vessels, showed what a hold the cold had taken of them, I reluctantly resolved to commence the descent. This I the more regretted, as it is not often possible to gain so great a height so early in the day, or in such glorious weather, and I should have liked to devote several hours to a careful examination of the details of the panorama which, under the circumstances,

was out of the question. Another reason against delay, was the possible effect of the increasing power of the sun, which might render the passage of the arête a matter of difficulty and danger. The champagne experiment was, unfortunately for science, a failure, from a similar cause to that assigned for the invisibility of the Spanish fleet by the Governor of Tilbury Fort in the "Critic" —

"The Spanish fleet thou canst not see,
Because—it is not yet in sight."

The bottle had been left behind at the col. My barometer was carefully replaced in its case, one more good look taken, and at 9.20 A.M. we were off.

The descent of the final slope had to be accomplished backwards, as the inclination was too great to allow of the heels being inserted in the steps; but the footing was firm, and we soon found ourselves at the upper edge of the bergschrund, which, it being as yet but slightly developed, we cleared by a flying leap. At 10.25, or in less than half the time occupied in the ascent, we reached the W. end of the arête, and soon had cause to congratulate ourselves on not having delayed our return, as, though our traces were still visible, the surface had become soft, and frequently slipped away beneath the feet. Treading with caution and as lightly as possible, so as not to disturb the slightly coherent snow, we proceeded rapidly onwards, and at 10.50 reached the col beneath the rocks of the Dreieckhörner. Here we halted, the barometer was set up, and preparations made for a hearty lunch. After an exposure of half an hour I read off the instrument, which indicated 497.2 millimetres (reduced), with an air temperature of -3.9° Cent., or 25° Fahr. This, compared with Geneva and the St. Bernard, gives for the height 11,864 and 11,778 feet respectively, or a mean of 11,821. A determined onslaught

was now made on the contents of our provision sack : the vigorous leap of the champagne cork proved an interesting and agreeable confirmation of the diminished pressure indicated by the barometer, and, in the foaming contents, most unmistakably iced, and strongly resembling acidulated pins and needles, we drank to the health of absent friends and our lately vanquished foe.

The earliness of the hour, the continued brilliancy of the day, and the total absence of all sense of fatigue, now suggested to me the idea that something more might be effected ; and, as I intended on the next day but one to proceed to Kippel by way of the Lötschsattel, it at once occurred to me that an attempt might be made with Victor and Peter to cross the ridge, and descend on the N. to the Aletsch glacier, which would, if we were successful, be reached at a point about two miles to the E. of the "Sattel."

Unfortunately none of us knew much of the character of the northern side of the mountain, and, as usual, it was difficult to judge from above of the nature of the obstacles to be encountered. That the descent must be extremely rapid we were well aware ; but from its position the sun could have had but little effect in softening the snow ; the frost was still keen in the shade, and we trusted to our ice-axe and alpenstocks, which had ere then taken us safely through many as doubtful a labyrinth.

The decision once come to, no time was to be lost in carrying it into effect : the wine-can and empty knapsack were shouldered by Bennen, accounts settled between us to his satisfaction, and, shaking him warmly by the hand, we parted with mutual injunctions, "*Acht zu nehmen*," — he of the concealed crevasses in the névé, we of the "*tiefer Abgrund*." We watched him for a moment as he went merrily down the mountain side, and then, after carefully roping, with long intervals between us, stepped over the

ridge, Victor in advance, I in the middle, and Peter bringing up the rear.

For some time we got on pretty well—a frozen “*croûte*” on the surface enabling us to secure our footing without having to resort to the axe; but the slope soon became of the rapidest (I estimated it at upwards of 40°), and many were Victor’s injunctions to “*assurer bien les pas*” and “*enfoncer le bâton*.” No precaution was neglected, and well was it for us all that we had not now to learn for the first time how to handle the trusty alpenstock.

We had accomplished in safety a distance of scarcely more than 150 yards when, as I was looking at the Jungfrau, my attention was attracted by a sudden exclamation from Victor, who appeared to stagger, and all but lose his balance. At first, the idea of some sort of seizure or an attack of giddiness presented itself, but, without stopping to inquire, I at once turned round, drove my good 8-foot ash-pole as deeply as possible through the surface layer of fresh snow into the firmer stratum beneath, tightened the rope to give Victor support, and shouted to Peter to do the same. All this was the work of an instant, and a glance at once showed me what had happened. Victor was safe for the moment, but a layer or “*couche*” of snow, ten inches to a foot in thickness, had given way exactly beneath his feet, and first gently, and then fleet as an arrow, went gliding down, with that unpleasant sound somewhat resembling the escape of steam, which is so trying to the nerves of the bravest man, when he knows its full and true significance. At first, a mass eighty to one hundred yards in breadth, and ten or fifteen in length, alone gave way, but the contagion spread, and ere another minute had elapsed the slopes right and left of us, for an extent of at least half a mile, were in movement, and, like a frozen Niagara, went crashing down the ice-precipices and seracs

that still lay between us and the Aletsch glacier, 1800 to 2000 feet below. The spectacle was indescribably sublime, and the suspense for a moment rather awful, as we were clinging to an incline at least as steep as that on the Grindelwald side of the Strahleck — to name a familiar example, — and it was questionable whether escape would be possible, if the layer of snow on the portion of the slope we had just been traversing should give way before we could retrace our steps.

Not a moment was to be lost; no word was spoken after the first exclamation, and hastily-uttered, "*au col! et vite!*" and then in dead silence, with bâtons held aloft like harpoons, ready to be plunged into the lower and older layers of snow, we stole quietly but rapidly up towards the now friendly looking "*corniche*," and in a few minutes stood once more in safety on the ridge, with feelings of gratitude for our great deliverance, which, though they did not find utterance in words, were, I believe, none the less sincerely felt by all of us. "*Il n'a manqué que peu à un grand malheur*," quietly remarked Victor, who looked exhausted, as well he might be after what he had gone through; but a *goutte* of cognac all round soon set us right again, and shouting to Bennen, who was still in sight, though dwindled in size to a mere point, we were soon beside him, running down the *névé* of our old friend the Aren glacier. The snow was now soft *

* The contrasts of temperature in mountain regions are sometimes very striking.

In a few moments the traveller exchanges an arctic for a tropical climate or *vice versa*, and to sensitive persons this meeting of extremes is sometimes productive of much discomfort.

Hugi, in the interesting description of his perilous attempts to ascend the Finsteraarhorn, mentions ("Naturhistorische Alpenreise," page 194) that within a few hours the thermometer had ranged from -10° Reaumur to between $+20^{\circ}$ and 30° ($9^{\circ}5$ to 77° or 99° Fabr.); and I have no doubt the extremes were equally great on the occasion above referred to. Near the

and the heat tremendous, and both Bennen and Bohren showed signs of fatigue; but a rapid pace was still maintained in spite of the frequent crevasses. Some were cleared in a series of flying leaps, whilst into others which the snow concealed, one and another would occasionally sink, amid shouts of laughter from his companions, who, in their turn, underwent a similar fate. To the carefully-secured rope, which with the alpenstock and ice-axe are the mountaineer's best friends, we owed it that these sudden immersions were a mere matter of joke; but even the sense of security which it confers does not altogether prevent a "creepy" sensation from being experienced, as the legs dangle in vacancy, and the sharp metallic ring of the icy fragments is heard as they clatter down into the dark blue depths below.

Suddenly, to our great surprise, on rounding some seracs, we came upon Bürker in a state of amusing bewilderment. He had somehow contrived to quit the track, had next dropped his bâton into a crevasse, and, after struggling on some little distance, had got into such a confused state of mind that he dared venture no farther, and resolved to await our return. Relieving him from his icy

summit of the Col d'Argentière, at 10.25 A.M., July 2nd, 1860, a thermometer in the shade stood at 0° Centigrade (32° Fahr.), whilst one with a black bulb exposed to the sun, which was by no means so powerful as I have often found it on such occasions, indicated 35°·5 C. (92°·3 Fahr.), a difference of 60° Fahr. Dr. Hooker ("Himalayan Journals," vol. ii. Appendix, page 410, 1st edition) records still more extraordinary results in the following terms:—"At 10,000 feet, in December, at 9 A.M., I saw the mercury (in a black bulb thermometer), mount to 132°, with a difference of + 94°, whilst the temperature of shaded snow hard by was 22°; at 13,100 feet, in January, at 9 A.M., it has stood at 98°, difference + 68°·2; and at 10 A.M., at 114°, difference + 81°·4, whilst the radiating thermometer on the snow had fallen at sunrise to 3°·7. In December, at 13,500, I have seen it 110°, difference + 84°; at 11 A.M., 11,500 feet, 122°, difference + 82°. This is but a small selection from many instances of the extraordinary power of solar radiation in the coldest months at great altitudes."

prison, our united party proceeded on its way; the glacier was at length traversed, the rocks climbed, and, bathed in perspiration, and, like Chaucer's Sompnour, with "fyr-reed cherubynes face," we entered the cave at 1.20 P.M., after an absence of about eleven hours.

As there were still many hours of daylight left, it was resolved to remain quietly here till the intense heat should have a little abated. And soon the prostrate forms and loud breathing of my companions showed that they appreciated and were availing themselves of the luxury of repose. I had plenty of occupation in completing my notes, observing the barometer, which indicated a height of 8896 feet, and depositing a record, with a rough map of our route in an empty bottle, to be left in a crevice of the rock for the benefit of future comers. As the remainder of our stock of wine was served out, I proposed that our quarters should be christened the "*Gasthof zum Bennen*," in compliment to that worthy, and the prosperity of the house was drunk with all the honours. Our traps were then collected, the few remaining bits of wood put in a dry corner *pro bono publico*, and at 4 o'clock, not without feelings of regret, we quitted the spot which had afforded us such good shelter, and had begun by this time to feel quite homeish.

At 5 P.M. we gained the level surface of the Aletsch glacier, at 6 the head of the Märjelen See was reached, and at 8.15 P.M. we entered the hotel, amidst the warm greetings of M. Wellig and his staff.

Little more remains to add; but I cannot close this paper without some allusion to the admirable qualities which Victor had shown throughout the expedition. Cool, cautious, and yet daring as the bravest where my wishes or circumstances called forth the exercise of the latter quality, I found him then, as I have ever found him

before and since, equal to any emergency. We have roughed it together in storm and shine, in cold and heat, on breezy col and rugged peak, and I should be ungrateful did I not here bear testimony to his excellence. I may add that I do not know his equal as a care-taker of ladies, in which capacity he acquitted himself in 1860 *à merveille*, under rather trying circumstances.*

A few words by way of summary, and I have done. Since my ascent, the summit of the mountain has, if I am not mistaken, been only once attained, by a party of English gentlemen, who, I believe, encountered no more serious difficulties than had attended my expedition. I would, however, venture to recommend the excursion, as deserving the more frequent attention of mountaineers, not only from its intrinsic interest, but because it possesses many not unimportant advantages over those to the Finsteraarhorn and Jungfrau. With the last-named mountain I am not personally acquainted, but its position is less central, and I imagine that it must therefore be inferior as a point of view. As to the Finsteraarhorn, I can speak from my own experience, having had an opportunity in 1860 of gaining its summit; and my opinion is that, though the distant view is necessarily very similar, the Aletschhorn, on the whole, offers finer grouping in the nearer scenery. Apart from this, however, there can be no question that the position of the night-quarters at the Faulberg and "*Gasthof zum Bennen*," in relation to the respective mountains, is decidedly in favour of the latter.

* In offering these remarks, it will, I hope, be understood that I by no means wish to make an undue distinction between Victor and such other first-rate fellows as Melchior Anderegg, Bennen, Perrn, Auguste Balmat, Auguste Simond, Croz, and many more, who are not to be surpassed in all that constitutes excellence in a guide and pleasantness in a companion; but it has been my lot to be thrown more with Victor than with any of them, and in him I naturally feel a special interest.

The distance to be traversed is very much shorter, as a glance at the map will show, and the necessity, as in returning from the Finsteraarhorn either by the Grünhorn Lücke or Viesch glacier, of reascending or traversing a dangerously-crevassed glacier, perhaps at a late hour, is exchanged for an uniform and a gentle descent over broad and open surfaces of ice.

NOTE 1.

The boiling apparatus referred to in the preceding narrative was constructed for me by Mr. Stevenson of Edinburgh some years ago, and has been my constant companion in the mountains. By a simple arrangement, it is rendered equally adapted for cooking or hypsometrical purposes: a thermometer inserted in a steam-chamber furnishing the means of ascertaining the boiling point, from which the altitude is obtained either by a special formula, or with the aid of Regnault's Table of Equivalent Pressures. The chief peculiarity of the "*machine*," however, consists in the "Russian furnace," the action of which is rather facilitated than impeded by wind, and is so powerful and rapid that snow pressed down tightly in an electro-plated copper vessel or "*casserole*," holding about a quart, may, by means of it, be converted into boiling water, even at the greatest altitudes, in from three to four minutes. This ingenious contrivance is, in principle, a self-acting blow-pipe, vapour of spirits of wine being the agent employed. A small copper saucer is filled with spirit from a measure provided for the purpose, and upon it is placed a cylindrical chamber with hollow centre, which has been similarly charged through a hole at the side. This hole being closed with a screw, there is no vent left for the enclosed spirit but a curved tube with extremely narrow orifice. The spirit in the saucer being ignited, soon causes that contained in the closed chamber to boil; vapour of spirit is given off, which escapes with loud noise through the tube; and there, being ignited, rushes up through the hollow centre of the cylinder with great force and a blue flame, the intense heat of which renders it alike adapted to the laboratory or the mountain top,—to the boiling of a thermometer, or the preparation of soup, tea, coffee, and chocolate.

NOTE 2.

On the "Phosphorescence" of Snow and Ice.

The following observations and remarks with reference to this phenomenon may not be without interest. They occur in the interesting work of the MM. Schlagintweit ("Neue Untersuchungen, &c., pp. 479-80) already alluded to.

"On the snow-clad slopes of the Alpine summits, and, during winter, even on snowy surfaces in the plains, a peculiar brightness ('*Helligkeit*') is occasionally observed during the earlier hours of the night.

"In the Alps, the appearance recalls the 'second colouring' after sunset, and frequently immediately succeeds it, without, in my opinion, being connected with it. I cite a few examples.

"From the Vincent-hütte we frequently remarked, especially during the night of September 12-13, 1851, that the snow-fields throughout the night stood out clear from the background, notwithstanding that the sky was obscured by an uniform stratum of clouds; although the moon was near the full, not even the slightest glimmer indicated the existence of open spaces between the clouds, parallaxically concealed from us. In the valleys, too, of Piedmont and Switzerland, we repeatedly noticed a greater brightness of the snow in contrast with the uniformly obscured sky. As, however, it is impossible in the valleys to command such a view of the horizon as is obtained at the Vincent-hütte, the supposition cannot be altogether excluded that oblique illumination may have been the cause, though the absence of the moon, and the clouded state of the heavens, render this improbable.

"The following observations may be cited as instances of similar phenomena:—

"Professor Bertz informed me that, when crossing the Col de Balme on a night so dark that it was impossible to distinguish the nearest objects, the Glacier des Bois (Bossons?) could be seen with perfect distinctness, as a luminous surface on the farther side of the valley of Chamounix.

"In the Vallais a similar appearance was observed during the winter of 1851 on the snow-covered declivities of the Rhone valley.

"During the stay of Agassiz at the 'Pavillon' (on the lower

glacier of the Aar), a peculiar luminosity of the glacier, which here lies at a depth of nearly 100 mètres, was remarked.

"As was to be expected, the phenomenon was most distinct during the darkest nights.

"The appearances here referred to point very clearly to a light evolving property in snow, through phosphorescence. Snow and ice, especially large pieces of the latter, become slightly but quite distinctly phosphorescent when brought into a dark room after exposure to light at a temperature several degrees below the freezing point. The light appears of a bluish colour.

"Placidus Heinrich, in his numerous researches into the phosphorescence of various bodies, has also investigated ice, and found it weakly phosphorescent.

"During the winter of 1852-3, and especially on the 27th of February, 1853, I had opportunities in Berlin of observing on a large scale the luminosity of the snow. With a grey and uniformly clouded sky, it was quite clear that the roofs of the houses stood out distinctly from the background. In order to exclude the possible effect of the lighting of the streets, I repaired to Schöneberg, where, about 9 P.M., the (proportionately great) relative brightness of the snow, both on the roofs and surface of the ground, was very distinctly seen. Throughout the winter, however, the appearance was comparatively rare, and by no means presented itself on every dark and cloudy night. A sudden overclouding, following rapidly on an active '*insolation*,' or intense cold in the night, freezing the water with which the snow has been saturated during the day, appears to be particularly favourable to its development. On the other hand, I never observed the luminosity when a fall of snow had taken place shortly before nightfall, although fresh snow is always intrinsically whiter than that which has been exposed for some days to atmospheric influences.

"The relative luminosity of the snow was never very considerable; and though sufficiently so, indeed, as has been said, to be clearly perceptible, it was limited to such surfaces as were directly bounded by the sky."

From the above passages, it will be seen how remarkable, both in extent and intensity, was the phenomenon witnessed by me on the night of June 17th.

4. FROM THE GRÜTLI TO THE GRIMSEL.

BY R. W. ELLIOT FORSTER.

Sonnenberg—The Uri Rothstock—Engelberg—A Thunderstorm—The Stein Glacier—The Thierberg—The Triften Joch—The Glacier of the Rhone.

IT is rather the fashion now-a-days to believe nothing. Now I, on the contrary, believe a good deal;—I believe that Homer and Julius Cæsar both lived; I believe in William Tell; all the learned arguments of Archbishop Whately have failed to convince me that an emperor of the name of Napoleon did not reign over the French in the beginning of this century; and I likewise believe in Walter Fürst, Werner Stauffacher, and Arnold von Melchthal. Considering, however, the great historical infidelity which at present prevails, it is refreshing to find that a far different spirit animates the Helvetian youth.

The field and wood on the Lake of Lucerne, known as the Grütli, or Rütli, have recently been purchased, chiefly by means of a subscription raised in the Swiss schools; the ground has been prettily laid out under the auspices of the Government; and the authorities, with great good taste, have stopped the erection of a place of entertainment, which a speculative Swiss hotel-keeper was building, and which would have had the effect of turning the hallowed shrine into a tea-garden. It would scarcely be possible to perpetuate a testimony to the existence of the three great

founders of Swiss liberty in a more effectual or more graceful manner than by preserving intact the spot where those heroes first swore to rescue their native land from foreign thralldom.

Early in the month of August, 1861, I landed at the Grütli from Brunnen, on my way to the new *pension* at Sonnenberg, on the Seelisberg, where I intended passing a few days to get myself into training for a walking tour. The most desirable of these Swiss boarding-houses appear to be little known to the majority of British tourists; and, although I should be extremely sorry to introduce Brown, Jones, and Robinson to all my mountain haunts, I think that it is only Christian charity to inform the hundreds who annually melt in the broiling sun of Geneva, Vevay, Interlaken, and Lucerne, that there are such places as Champéry and Comballaz in the west, and Sonnenberg, Engstlen, and the Frohnalp in the centre of Switzerland, where, in addition to being housed and fed, they can freely breathe.

On Sonnenberg I had now especially fixed my eye; and, not having been well for some time, I began operations by running up, in half an hour, a somewhat precipitous path, said to be the very path by which Arnold von Melchthal was in the habit of reaching the Grütli from his home in Unterwalden, and which most persons usually take an hour to ascend, and sometimes, as appears from the stage directions in Schiller's "Wilhelm Tell," by the aid of a ladder.

The day was hot, and the effect was pretty much the same as that produced by the first part of a Turkish bath. Finding a delightful little lake—the Seelisberger See,—not far from the *pension*, I jumped into it and performed part two, and then completed the course by lying down in the sun to warm myself. I derived so much benefit from the process that I repeated it, and in four days I was ready

for anything. I ought, however, to add, that in all probability the good fare at Sonnenberg, and the pure mountain air that is inhaled at every breath, contributed not a little to perfect the cure. I can recommend the establishment of M. Truttmann, who is a member of the Cantonal Government of Uri, to English travellers. They will find there good accommodation at a very moderate rate, amidst scenery of great beauty. The house is perched on a rock immediately over the Grütli, and commands a lovely view of the Lake of Lucerne, into which a stone might almost be thrown from one's bed-room window, but, at the same time, it is sufficiently high up not to be affected by the damp air which often pervades the banks of the lake after sunset. The excursions to be made in the neighbourhood are numerous, and not difficult. Two or three of the walks, as a retired Indian officer told me with great delight, are "on the flat;" and some of my fair readers, if I am fortunate enough to have any, will be glad to hear that they will find grasses and ferns without end, to say nothing of cyclamens and other Alpine flowers, and they may repose themselves under the shade of maple, ash, lime, beech, or walnut trees, without fear of being molested.

I could have remained there with pleasure for a fortnight, and might possibly have done so, had not the Uri-Rothstock, whose proud summit I saw every morning from my window, constantly reminded me that I had once vowed (it is unnecessary to state under what circumstances) to walk to Engelberg from Isenthal, going over its highest peak *en route*, and thence to proceed to the Grimsel by the glacier of Trift. The weather was magnificent, and the time seemed now to have arrived for fulfilling my vow; so I bade farewell to M. Truttmann on Monday, the 12th of August, and started for the valley of the Isen.

It is a charming walk from Sonnenberg to Bauen on the Lake of Lucerne, whence it took me about two hours and a half to reach the Adler, at Isenthal, at which nice, clean, primitive little inn I put up for two nights. The landlord, Joseph Imfanger, a well-known chamois hunter, who afterwards acted as my guide to the Uri-Rothstock, and who, now that his father is nearly superannuated, is the only man in the place who can be relied on in difficult expeditions, was from home when I arrived; but I received every attention from the hostess, and from the veteran old Carl Imfanger, her father-in-law, who related a number of sporting anecdotes which had occurred, or which he stated had occurred, "in the days when he was young." I was also very much patronised by the daughter of the hostess, a young lady of four years of age, who lionised me about whilst her mother was preparing my supper; and, amongst other things, she showed me the paws of an enormous bear, which had been shot by her father a few days previously, and which were hung up at the entrance of the village as a trophy.

The 13th of August, 1861, was a memorable day for Isenthal,—a large armed force passed through it in full marching order, carrying all the means and appliances that modern science has devised to gain a battle, as well as to alleviate the consequences of a defeat; the former—the rifles, the cannons, the powder and other ammunition—greatly stimulated my *Volunteer* ardour; but I confess that when I surveyed the latter—the lint, the ambulance, the knife, the saw, and other agreeable-looking surgical instruments—it rather took the edge off my martial appetite. Two hundred men actually encamped in the village, and a precious noise they made. I had retired to bed early, as I was to start at 2 o'clock the next morning for Engelberg, and I was desirous of getting a

few hours' sleep; but this I soon found was utterly impossible, so I resigned myself to the serenade which the band kept up under my windows until past 11, and at 1 o'clock I got up.

There are two routes by which the Uri-Rothstock can be approached from Isenthal—the one by the Higher Valley, known as the “Gross-Thal,” which lies rather to the westward, and the other by the “Klein-Thal,” which is immediately opposite the village, and ascends in a direct line from N. to S. I was strongly advised to go by the Gross-Thal; I was told that it was much easier—that it was *ganz bequem*; and, when all other arguments had appeared to fail in making any impression on me, I was informed by my hostess that a bishop had once been that way! This clenched the matter: I said that I should not presume to walk in the footsteps of the prelate, and that the Klein-Thal was the road for me; and accordingly by the Klein-Thal I went. I rather suspect that the military had not limited their jollification to listening to their band, that they had indulged in something more exciting than music, and that the host had kept them company; so I was not at all sorry when the latter told me, just as we were about to start, that he would take his stable-boy to carry my knapsack, and that he himself would carry the provisions. It is only just, however, to mention, that they did not require or expect any additional remuneration for this, and that when, on parting, I gave the boy two francs for *Trinkgeld*, both he and his master appeared to be pleased and surprised. My agreement with Imfanger had been, to give him twenty francs if I took him on to Engelberg, and ten francs if I sent him back from the Uri-Rothstock, which was what I intended doing, unless the weather turned out badly. At 2.10 A.M. we started. It was not very dark, and we de-

terminated not to take a lantern, which, perhaps, was rather imprudent. In the woods we took off our coats, and could distinguish each other by means of our light-coloured shirt-sleeves, and, barring the chance of being shot by the sentinels on leaving the village, and that of being drowned in one or two torrents into which we were nearly precipitated, we did not incur much danger from the want of light.

After walking up the Klein-Thal for two hours and a half over grass and through a forest, we came to a steep wall of stratified limestone, which forms the northern boundary of a field of ice and snow extending from the Gutschen, or Gitschen, to the Uri-Rothstock; down this wall, or screen, trickles the water from the melting of the snows above, so that the footing is not very good, and we were often obliged to pull ourselves up with our hands along the shelving rock on our right. Under this rock we sat for some time watching the rising sun, as it tinted in succession with a rosy hue the different peaks around us. Soft and beautiful as is a fine autumn sunset, in a mountainous country I prefer the effect of sunrise, as in the morning the atmosphere is so much clearer, and the outlines are so much sharper, than is the case after the mid-day sun has called forth the vapours from the valleys beneath. It was just 6 A.M. when we left the rock and took to the snow. Here, of course, the rope was produced, and we proceeded in single file, Imfanger being first, and I coming next; the boy, who followed me, held the rope in his hand, but he preferred not being tied. Many persons fancy that they are safer when the rope is not tied around them; but on snow this is a great mistake, for it is of immense advantage to have both your hands at liberty, and if you fall into a crevasse you are very likely to lose your hold of the rope at the moment you most want it. The boy was a mere volunteer, so I let him do as he liked; but I

seldom allow a regular guide to keep the rope in his hand. If my host had at any time felt the effects of the potations of the night before, the sharp, keen air of the glacier had now entirely brought him round, and his ear caught the distant whistle of the chamois as rapidly as his eye distinguished the treacherous snow that covered the *bergschrund*. We had a large plateau of névé before us, which we were obliged to ascend almost as far as the Geisshörnli, a peak immediately in our front, although our course eventually lay much more to the right; as a wall of ice, several hundred feet in height and nearly perpendicular, separated us from the glacier which descends from the eastern shoulder of the Uri-Rothstock, and which it was necessary for us to cross in order to reach the desired summit. We ran along for some time under this ice-wall; but, before we had gone far, we had the clearest possible notice that it would be safer to keep more out in the centre of the névé, as we came upon the remains of an avalanche which had only recently fallen, and the blocks of ice, some of which weighed more than a hundredweight, and which, falling on snow, had not been ground to powder, as is frequently the case, did not look at all inviting. Nearly all these pieces of ice were angular, and many of them were square, and about the shape and size of an ordinary Paris paving-stone. Towards the middle of the plateau we found some large crevasses, which extended from E. to W. for a considerable distance, and which might have delayed us a good deal; but the snow was firm, and we generally could jump them without making any great circuit. On one occasion, however, the edge gave way with the boy, and from the tug he gave the rope I think he must have been glad to have had a good hold of it.

We proceeded to within a few hundred yards of the

Geisshörnli, when we turned to the westward, and keeping the Uri-Rothstock rather on our right, we crossed a low ridge of rock, and found ourselves at the very foot of the cone.

This cone, which it took us about fifteen minutes to get up, is the highest point of the Uri-Rothstock, which forms so prominent an object in most of the views from the Lake of Lucerne. The top, chiefly composed of a reddish kind of limestone, is seldom entirely covered with snow; indeed, on two sides, the north and the east, no snow could lie, as the rock is there almost perpendicular. The cone can only be ascended from the S.; but on that side there is no difficulty whatever: the incline is very gradual, and there are a number of small flat stones, as well as shaly matter, which make it easy going.

It was just 8 A.M. when we reached the summit, and we were quite ready for our morning meal. Ham, veal, chicken, were successively tried, and highly approved of, and we had just finished a bottle of Roussillon, when I perceived, what I at first thought must be some stray goats, ascending the W. side of the mountain. One glance with the telescope, however, soon showed that no goats could live on such a spot; and in a few minutes I reported to my companions that fourteen chamois were coming up the cone. English deer-stalkers can easily understand the excitement of the party; no one uttered a sound, but an impotent lament at not having a rifle was the idea that simultaneously rushed to the mind of each. The chamois were coming down wind, and had evidently not discovered us; for the sense of smell is so acute in the chamois, that it depends almost as much on scent, as on its bright black eye, to escape from its great enemy, man.* On they came

* It is confidently asserted that chamois can scent a man at a distance of more than a mile, and that it frequently happens that a whole herd will

in a close, compact body, a fine old male, with a white throat and forehead and splendid horns, leading the way, until they were within 200 yards of the spot on which we were standing. As far as we could judge, there were only three or four males; as, however, the females have horns, it is very difficult to distinguish the one from the other. The coat of the leader was almost black, and I could perfectly see the dark band that encircled his forehead and cheeks, as for an instant he looked up and surveyed us with unfeigned astonishment. Of course his gaze lasted but for an instant, and then, followed by the rest, he dashed along a narrow ridge on the north side of the mountain, which was apparently only a few inches in width. We were immediately above this ledge, and we threw one of our wine bottles into the midst of the herd, at the same time giving such a *view-halloo* as I should think had not often resounded in these regions. The chamois did not lose their footing; but their consternation was so great that, like a panic-struck army, they no longer obeyed nor understood the commands of their chief, and they were scattered in every direction, several of them again coming within rifle-shot of us. We watched them for a long time, and as two of them crossed at full speed the snow-fields we had just come over, I had an opportunity of forming some estimate of the pace at which they went. I should say that they did a mile in something less than three minutes; but as one of them, a male, stopped once or twice, for a few seconds, in order to call some of his terrified, or faithless, wives (I know not which), I am inclined to put down their pace as at the rate of twenty-five miles an hour. This chamois, regardless of the example shown him by the present Sultan,

cross a mountain ridge to avoid a party of hunters whom they have neither seen nor heard.

did not seem inclined to reduce the ladies of his harem to so low a number as one; and having arrived at the centre of the glacier he came to a halt, called, or rather whistled, louder than before, stamped his feet, and even retraced his steps for a short distance, with an air which implied, that some one would suffer for it if he were not instantly obeyed. In a little while three females left the shelter of a shelving rock, under which they had taken refuge, and joined him; and the party, now five strong, galloped off towards the Gutschen. At *Treibjagden*, or *battues*, both in Bavaria and in Styria, chamois have rushed by me at a distance of one hundred yards or less; but I never saw a herd deliberately approach me so near as these did.

The distant prospect from the Uri-Rothstock is not so extensive as that from the Titlis; but the near, or glacier view, is very grand. This mass of névé and ice forms a vast parallelogram, extending from the Gutschen to the Weissberg; and, with the exception of the Rothstock glacier, which is on the S. side of the snow-shed, and descends from the Engelberg-Rothstock to the top of the Herbis-Thal, chiefly consists of what Monseigneur Rendu, in his "*Théorie des Glaciers*," calls *Glaciers Réservoirs*, as opposed to *Glaciers d'Écoulement*. The névé between the Uri-Rothstock and the Engelberg-Rothstock requires very nearly two hours to cross, and is known by the name of the *Blümlis firn*; it is, in fact, the "Jardin" of this part of the Alps. Near the Rothstock, I settled money matters with my host, and he and the *knecht* returned home by the Gross-Thal, whilst I shouldered my knapsack and proceeded towards Engelberg.

I had still a good piece of ice to go over; but, as I was well acquainted with the glacier of Rothstock, which I had explored in previous years, I took it very leisurely, and

collected a number of curious plants and mosses, with which the rocks, which here and there jut out above the snow, abound. On one of these isolated peaks I sat for nearly an hour, in thorough enjoyment of the scene around me. On my right stood the Engelberg-Rothstock, ineffectually trying to screen a loftier rival, its namesake of Uri, and beyond, that splendid wall of limestone (in some places upwards of 2000 feet in height) which extends westward as far as the Wallenstock; on my left rose the Weisstock and the Weissberg, whence descends in a graceful slope the snow-field, or *Glacier Reservoir*, which forms a lateral but important feeder to the Rothstock glacier; and, nearer still, the Gemsenspiel, or Chamois' game, which three chamois abandoned whilst I was looking at it, seeking another play-ground on the opposite side of the glacier. Immediately in front of me were the mountains which form the western boundary of the Engelberger Thal, and, with the hooded Titlis and the rugged peaks of the Spannörter, complete the amphitheatre by which the upper part of that charming valley is encircled.

I descended the Rothstock glacier nearly to its lowest point, occasionally getting a glissade; and at 3.30 P.M. arrived at the first châteaux. Here I was glad to have a halt, and in a few minutes I had disposed of a large wooden bowl of thick cream, which the chief *Senner* presented to me. The weather was still very hot, so I determined not to go down to Madame Cattani's excellent "Hotel et Pension de l'Ange" at once, and accepted an invitation of some of the cowherds to inspect their stock. In their pigs I did not take much interest; but the cows, most of which, I believe, belonged to the monks of Engelberg, were fine specimens of the Alpine breed. Here I witnessed one of those fights, so common in Switzerland, which take place between two cows for the command of

the herd. The vanquished cow, who had previously led the way with a haughty step, and would have instantly punished any act of insubordination in those over whom she ruled, now hung down her head, and submitted without a struggle to have her bell, the *insigne* of her rank, transferred to her conqueror.

Engelberg is reached from these châteaux by a steep zigzag path which winds through the most luxuriant pasturages. Their exquisite verdure was so refreshing after the glare of the snow, that I lingered long amidst them, and the sun had already left the valley when I approached it; but the snowy peaks that surround it, reflecting, as they did, the bright ruby light, with which the whole western horizon appeared to be inflamed, bore testimony that, glorious as had been the morning greeting of the sun, scarcely less sublime was his eventide farewell.

The first part of my vow had now been accomplished, and I thought that I might well pause and make a few excursions in the neighbourhood of Engelberg before proceeding over the Trift glacier, which was to complete it. Time and space will not allow me to describe all my rambles in that delightful locality, but I cannot resist asking the reader to join me in a walk to the Surenen Egg, on account of the imposing meteorological phenomenon I there witnessed.

On Saturday, August 17th, I accompanied some friends, who were going to Altdorf by the Surenen, as far as the Egg, or summit of the ridge, which is almost immediately under the Blackenstock, and about four hours' walk from Engelberg. The Surenen is a wild, dreary pass, and, as I looked up at the precipitous sides of the Geissberg, the Grassen, and the Schlossberg on our right, and at the dark Blackenstock on our left, I could not help thinking that the locality would not be a pleasant one to be alone in on a

dark night. At the top of the pass I quitted my friends, and retraced my steps towards Engelberg. As I went, I fancied that I might vary my route, and proceeded, at a higher altitude, along the shoulder of the Weisstock, intending to descend by the Fürer Alp, near the farm of Herren Rüti.

Before I had made much progress on my homeward journey, the weather suddenly changed; and I perceived a thick cloud travelling at a rapid rate up the gorge below me. This cloud was intensely dark, and formed a splendid background to the flashes of lightning which, at short intervals, lit it up, now in a dazzling column hundreds of feet in height, now in a horizontal zigzag extending the whole length of the valley. I had only on one previous occasion been fortunate enough to witness a thunderstorm from above; and I surveyed the floating torrent of aqueous vapour, charged with electricity, hurled on, as it was, by the Föhn*, or south-west wind, which now blew a perfect hurricane, with mixed feelings of awe and delight. The noise of the thunder was almost deafening, and the sun, which had hitherto been shining over my head, soon became obscured by another mass of vapour which forced its way over the Weisstock, and uniting with the lower cloud, from which it had probably been torn, burst like a water-spout, and all around was deluged with hail and rain. I lay for some time with my face towards the ground, protecting my neck with my hands from the hailstones, many of which were as large as Minié bullets, and generally of a conical shape; but I was obliged to change my quarters, as a shower of stones, which had been detached from the

* The Föhn raged with fearful violence in many parts of Switzerland on this day, August 17th, 1861. At Interlaken upwards of thirty of the beautiful walnut trees, which formed one of its chief ornaments, were levelled to the ground in a few minutes.

rock above, selected the particular course in which I was for their headlong race. I took refuge below two of the largest of these stones, which, luckily for me, had become embedded in a mound of earth a little above; and, being now comparatively in a place of safety, I amused myself by endeavouring to count, however vain the attempt, the number of times the peals of thunder were re-echoed in the distance. The storm only lasted about twenty minutes, and, as may be supposed, I did not linger much on my way home.

From Engelberg I went to the Stein Alp on the Susten Pass, by the Joch and a little pass called the Sättli to the W. of the Gadmenfluh, which is well known to the natives, but which they are unwilling to show to strangers. By adopting this course, or by going over the Grassen, a fine glacier pass, a day's journey is gained in proceeding to the Gadmen Thal, and some parts of the scenery are very beautiful.

The Stein glacier descends from the snow-fields, which at an altitude of nine thousand or ten thousand feet extend from the Sustenhorn to the Thierberg, and, having forced its way through the buttresses thrown out from those mountains, in three nearly perpendicular ice-streams of upwards of one thousand feet in height, it again unites, and, in conjunction with the Steinlimi, a channel of névé inclining to the eastward, between the Thierberg and the Radolfshorn, flows on in a comparatively even and uninterrupted course to within two hundred or three hundred yards of the Stein Alp, the lower portion, like that of the Rhone glacier, resembling somewhat in form the paw of some gigantic antediluvian animal.

At the little inn at the Stein Alp I met General Dufour's son-in-law, Mr. Hardy Dufour, who for the last twelve years has been employed in preparing the beautiful map

of Switzerland which bears his name, and which he tells me he hopes to be able to complete by the end of the year 1862. He had engaged old Weissenfluh, the well-known guide, to go the next morning to some commanding elevation, in order to give him the names of the principal peaks in the neighbourhood, and for this purpose the Sustenhorn and the Thierberg had been proposed. He kindly invited me to join him—an offer I did not hesitate in accepting. Mr. Dufour was accompanied by his nephew, a young engineer from Neufchatel, and by a servant who has been with him in all his mountain expeditions. Old Weissenfluh—I beg his pardon, Johann von Weissenfluh—for I am told that he boasts of having noble blood in his veins,—was to arrive in the course of the night from Mühlestalden, where he resides; so that our party consisted of five in all. Long before daybreak Von Weissenfluh was hammering away at the door of the little inn, and very shortly afterwards we sallied forth, having despatched our *café-au-lait* whilst we were dressing. My preparations for the expedition had been very simple, namely, adding a bottle of wine to the provisions that had been prepared for the rest of the party, and which, as is almost invariably the case, were more ample than necessity required.

We crossed the brook in front of the inn, and went along the W. bank of the Stein glacier, under the Radolfshorn, called by Weissenfluh Radlehorn, for about twenty minutes, and then descended to the ice and traversed the glacier, bearing towards the S.W., until we reached the mass, chiefly granitic, which separates the middle from the western ice-cascade, leaving the Steinlimi on our right. This rock, which in some places is exceedingly steep, is not difficult to climb, as small cavities have, in the course of ages, been made in its polished and striated surface. These cavities are often filled with

moss, and we used them as steps, sometimes placing the points of our feet, sometimes our hands, in them. Occasionally, it must be admitted, the moss came out of its receptacle and fell on the glacier beneath; and having lost all hold, down we came on our faces. We discovered various traces of serpentine, and often our compasses were so much affected by it as to be quite useless. It took us three hours and a half to reach the snow-plateau above the ice-cascades from the inn; and here we made a good halt, in order to prepare ourselves for the *névé* and snow we had now to encounter. Whilst we were discussing the Rhenish wine and cold mutton which our landlord had provided us with, we saw two chamois, and we afterwards followed their track as far as the *Kamm*, or col, between the Thierberg and the Sustenhorn. This *Kamm* is common to both mountains, and from it either summit may be reached.

We held a council of war as to which was to be attacked; but when we heard from Weissenfluh that the snow on the loftiest peak of the Thierberg had not yet been trodden by human foot, whereas the Sustenhorn had, as we knew, been ascended four or five times, it did not require much deliberation in order to determine what was to be done: so the word of command was given, — “Right wheel, quick march!” and we started for the Thierberg. An hour’s sharp walking due S. up the plateau brought us to the *Kamm*, whence we looked over into the Geschenen Thal; the chief objects of interest having been some enormous crevasses in the snow, which, on that occasion, we only looked at in a cursory manner, and principally for the purpose of avoiding them, but which we examined with great care on our way down. These crevasses were of an elliptical shape, and extended for several hundred yards horizontally across the snow. They were of no great depth, — probably not more than forty or fifty feet, — the bottom

floor being periodically covered with fresh snow in the same way as the plateau above. The southern or upper wall was much higher than the northern side, and each annual accession of snow was clearly delineated by a band, the space between the bands varying from about two to three feet, according to the severity of the winter, and also to the amount of superincumbent pressure, the lower layers being naturally more compressed than those above them. Weissenfluh, who had watched the progress of some of these basins, said that they were originally mere cracks or *faults* in the stratified snow, and that they gradually increased in width and became of an oval shape; which he, in some measure, attributes to the action of the wind, as well as to the heat of the sun. At the col we turned our backs on the Sustenhorn, and progressed westward for twenty-five minutes, until we had almost got round to the S. of the Mamelon we were about to storm. Here we took breath, and enjoyed the glorious prospect around us, minutely reconnoitring the upper end of the Geschenen valley, almost *terra incognita*, I believe, to the generality of travellers; and then, applying ourselves in earnest to the steep incline of snow on our right flank, in half an hour we gained the ice-escarpment, and in a few minutes waved our flag on the highest point of the Thierberg, or rather Thierberge (as three mountains bear that name), the two chamois, who had retreated before us to the very summit, having ignominiously fled; a magnificent l  mmergeier hovered round the spot for some time, but at length he also flew away, persuaded probably that the position was untenable, and we remained in undisputed possession.

What I have perhaps rather figuratively called the ice-escarpment was an *ar  te*, or ridge of frozen snow, which runs along the top, and is so sharp that occasionally some of us found it more convenient to sit astride than to stand on it.

The Thierberg is only 11,136 feet in height, but, not being overlooked by higher mountains, it commands a magnificent view, especially to the S. and the E. The southern prospect includes the Valaisan Alps, from the Monte Leone to the Combin, and the eastern extends to the confines of the Tyrol and Carinthia. At our feet lay a sea of ice and névé, about twelve *stunden* in length from N. to S., and from three to five *stunden* in width



THE SUMMIT OF THE THIERBERG.

from E. to W., surrounded by peaks, the names of which Weissenfluh gave us in detail, and which will nearly all be found in the map which accompanies this paper.

The most prominent on the S. side were the Winterberg, the Schneestock, and the Galenstock, from whose snow-clad flanks descends the glacier of Dama, the Gorner of the Geschenen Thal, which is within a few hours of the

St. Gothard road, and yet is as little known as the Jökull of Iceland. To reach the Furca by going over the Galenstock from Geschenen, would be an excursion well worth trying. From the Thierberg we perceived that most of the existing maps of Switzerland have robbed the canton of Vallais of a portion of its territory, and transferred it to Berne; the snow-shed, which ought to form the boundary line, extends from the Diechterhorn to the Schneestock, and not to the Galenstock, as commonly represented.

We remained more than an hour at the summit, and then descended by a short cut towards the crevasses. These we reached in less than thirty minutes, and three quarters of an hour more brought us to the rocks. An avalanche of ice had fallen since the morning. Most of the blocks, like those from the Uri-Rothstock, were angular, and bore testimony to the cleavage theory. Near the ice-cascades we had some splendid glissades, in which old Weissenfluh, notwithstanding his sixty-three winters, invariably took the lead, and at a little before 6 P.M. we got back to the Steinalp, having had a delightful excursion. Supposing time to be an object, either the Sustenhorn or the Thierberg might be ascended from Stein in less than six hours, or say, nine hours to go and return.

Weissenfluh claims the Trift as a *spécialité* of his own, and I believe that the glacier of the Rhone has very seldom been reached from the Gadmen-Thal except under his guidance. He has built a refuge, or *Jagd-Haus*, on the Windegg, a barren rock, which passes for "an Alp" or mountain pasture, to the W. of the Trift glacier. This hut, no doubt, has many a time been looked on with grateful eyes by the tired chamois hunter, or the half-frozen traveller, driven to seek there a night's shelter from the pitiless storm; but on ordinary occasions it does not seem inviting. It has neither door nor shutter of any

kind, and the roof and walls are not entirely water-tight. Two-thirds of the mansion are fitted up as a kitchen and *salon*,—that is, the furniture thereof consists of a *marmite* and a stool, and the remaining third, which is divided from the rest by a plank, forms the sleeping apartment, and is covered with dry fern and hay.

It is impossible to reach the Grimsel in one day from the Steinalp Inn by the Steinlimi; so I determined to sleep at Weissenfluh's house at Mühlestalden, and to start from thence early the next morning. It was arranged that old Weissenfluh should go with me to the Hospice, and that we should be accompanied as far as the Jagd-Haus by his brother, who is a great mineralogist, and by his son Andreas, who was going on a chamois-hunting expedition.

At 1 A.M. on the 1st September we had some coffee and an omelette, and at 1.40 A.M. we started from Weissenfluh's house, Andreas armed with his rifle, the mineralogist with his hammer, I with my alpenstock, and old Weissenfluh with a lantern. We kept on the left bank of the Triftbach, ascending by a steep path which leads to some pastures on the Stotzigrat; the Mährenhorn, the peaks of which are so leading a feature in the landscape between Hof and Guttanen, being immediately above us. At our feet was a dark gorge, through which the torrent has frayed itself a course, and of which we from time to time caught a glimpse. We passed more than once over some loose débris, which gave way under us, and the splash which ensued warned us of the consequences of dwelling too long on one stone. In three hours we reached the foot of the Trift glacier, and here we descended on to the terminal moraine. The moon was in her last quarter, and presented a beautiful phenomenon; the narrow golden crescent, with its pointed horns, gleamed in the deep azure sky, and the remainder of the disc, illumined by the

light reflected from the earth, was of a pale silver-like blue, the entire circle being distinctly visible. This effect is frequently observed when the moon is in her first quarter, but it is the privilege of the early riser to witness it when she is in her last phase. On this occasion the excessive pureness of the atmosphere, and possibly the quantity of snow that surrounded us, added much to the effect. I watched it until the rising sun extinguished the minor luminary and lit up the scene; and then I discovered that my companions had deserted me, and I hurried up the zigzag path which leads to Weissenfluh's hut. When I arrived, the fire had been kindled and the coffee was made, so that I had a very short rest, every one being desirous of making the most of the magnificent morning that, in 1861, ushered in the month of September. We ascended the eastern shoulder of the Windegg, and here I sat down to contemplate the wonderful panorama before me. To the left were the precipitous sides of the Radolfshorn, and the serrated crests which form the western portals of the Steinlimi; to the right all access towards the Rhone was barred by the Triftenstock, the Steinhaustock, and the almost perpendicular ice-cascade of the Trift glacier, or rather, I ought to say, the *higher* ice-cascade, as the Trift possesses two ice-falls; and in the centre stood forth, in bold relief, an apparently inaccessible spur of the Thierberge, to which, I have since heard, the name of Teltistock has been given, backed by the Winterberg and the Schneestock. I confess that for an instant I almost began to think that the Trift Pass was a myth; and the notion was not quite eradicated from my mind when old Weissenfluh told me that our course lay over that spur, which we should have to surmount.

We traversed the glacier of Trift some distance below its higher ice-fall in thirty minutes, going nearly S.E.; and

then (the Trift glacier having little or no lateral moraine) we mounted at once from the ice to the spur of the Thierberge. An hour's good climbing, often hand over hand, brought me to the top of the spur, and then I saw that the Triften Joch was a fact, and not a very difficult one. Before me was a gently-inclined plain of névé and snow, and at the end of it was a rock which I knew, from our observations from the summit of the Thierberg, was the culminating point of the col. Here I lay down and waited for old Weissenfluh and his brother, of whom I had more than a quarter of an hour's start. Andreas had previously left us, having got wind of a chamois towards the Steinlimi. Weissenfluh, when he arrived, pointed out the Furtwand, a sort of gully running W. from the Triftenstock, through which there is a track to Guttanen in the Ober Hasli.

The mineralogist was about to explore some of the holes and caverns with which the Thierberge abound; so old Weissenfluh and I wished him success, and, having tied the rope round us, we took to the snow, and at 10.30 A.M. we were sitting on one of the slabs of granite with which the western side of the Triften Joch is covered. Here is cleavage with a vengeance. Not content with splitting the blocks in *one* direction in the manner we have all of us witnessed in slate quarries, here Nature has turned out rectangular tables of stone, as neatly finished on all sides as if they had been cut with a chisel. Many of these slabs are from 6 to 10 feet in length, and from 3 to 5 feet in breadth, the thickness being from 12 to 18 inches. They are generally found in a horizontal position, and they appear to have been hurled down by some convulsion from the Diechterhorn. On one of the largest we placed our provender, and having cooled the excellent Beaujolais we had brought from the cellars at Hof in the

snow, we devoted all our energies to our *Mittagessen*, a meal which, at an altitude of 10,000 feet, goes down with much more relish than it does at an altitude of 15,000, where one seldom has much appetite. A ledge of rock juts out from the Schneestock at a point nearly opposite these blocks of granite, and, with the snow which fills up the space between them, forms the boundary line that separates Berne from the canton of Vallais. This is the water-shed between the snows that feed the Trift and the Rhone,—the former a tributary of the Rhine, reaching the Northern Ocean,—the latter discharging its waters into the Mediterranean.

On the Trift plateau we discovered a large number of moths, driven there by the hurricane. These moths, some of which were of great beauty and of considerable size, were in a wonderful state of preservation, and their convoluted * wings were not in the slightest degree damaged. We found each individual imbedded in a small hollow in the snow, caused, no doubt, by the absorption of the sun's heat, and subsequently deepened by his genial rays, more merciful to its remains than the remorseless wind, which had brought it to this desolate spot to perish of starvation, had been to it whilst alive.

After a parting look at the Thierberg, for which I could not but feel a kind of affection, we descended the southern slope of the Joch to the glacier of the Rhone, keeping rather to the left, and passed immediately under the Galenstock. This noble mountain, to look at which one always feels half inclined to walk backwards when descending the Rhone valley, may easily be ascended from the Furca; but it seems to be quite inaccessible from the northern and western side. Between the Galen-

* *Crenellated*, or *crenated*, means *indented*; *convoluted* means gathered round their bodies; this, no doubt, preserved them from destruction.—*Author*.

stock and the Gerstenhorn we came upon some awkward crevasses, and, under the influence of the mid-day sun, the ice-bridges had melted considerably, and were not very safe. I went through twice ; but Weissenfluh pulled me out cleverly by a jerk of the rope, upon which, although tied round him, he kept his hand.



THE TRIFTEN-JOCH AND THE RHONE GLACIER FROM THE SOUTH.

The Rhone glacier is certainly one of the finest in Switzerland. Every one who has crossed the Grimsel and the Furca must have been struck with the graceful slants of its névé, the wild configuration of its seracs, and the terrific violence with which it ploughs up the sward at its foot ; but, to be able to form any adequate idea of its

grandeur, it is necessary to explore it in all its length and breadth. Sitting under the Galenstock, and looking up at the lofty peaks that surround the Joch, one may well be seized with a feeling of admiring delight, something, as poor Talfourd so beautifully expressed it, between the affection with which we embrace the earth, from which they are uplifted, and that mere transient admiration we feel while we watch the clouds with which they mingle.

We descended nearly as far as the ice-cascade, and then, turning due W., we crossed the glacier and ascended a flank of the Saasberg, a little above the Meienwand. It had taken us three hours and a half to get to this spot from the Joch: here we sat down, and I surveyed, with great delight, the Monte Leone, the Mischabel, the Weiss-horn, the Matterhorn, and the other giants of the Vallais to the S., and the monarch of the Oberland,—the Finsteraarhorn,—to the W. I also endeavoured to trace out the line by which the French General, Gudin, in 1799, reached the plateau above the Grimsel from Guttanen, avoiding the Hospice, which was in the hands of the Austrians. This is one of the greatest military Alpine feats that have ever been performed. The French followed the stream which flows from the little lake of Gelmer, ascended the glacier above the lake, climbed over the shoulder of the Gelmerhorn, and then surprised the Austrians by coming down on their rear by the Rhone glacier and the Saasberg.

There is no regular path from the Saasberg to the Hospice, or, at all events, we could not find any, and we descended to the Kleiner See pretty nearly by the same course as that by which the Saasbach reaches it, old Weissenfluh singing and *jödelling* all the way. It was 4.30 P.M. when we got to the lake; and, although I was not at all fatigued, still, after having been out fifteen hours,

“*on n'est pas fâché d'arriver,*” as my old guide very properly remarked. As we approached the Hospice, we found the usual number of guides and porters assembled at the door; “Trift,” “Triften Joch,” was uttered in divers quarters, the direction whence we came, and the rope coiled round Weissenfluh indicating pretty clearly what we had been about; and when we ascended the steps, I perceived at once, by the manner of the landlady, that our line of march met with her entire approval, and that by adopting it I had risen considerably in her estimation. I am not particularly partial to the Hospice of the Grimsel, and had it not been the starting-point for the Strahleck and the Ober-aar Joch, I do not think that I should have honoured it much of late years. On my last visit I had cut down the price of one of the guides of the establishment for a journey over the Ober-aar Joch, and I did not exactly know how I might be received; so it was very satisfactory to see that all was *couleur de rose*. “From the Trift?” was put inquiringly by the hostess. To this I nodded in the affirmative; upon which, pushing aside several unfortunate tourists from the Furca and Münster, who were patiently waiting in the passage to know whether they had any chance of a bed, she preceded me, with considerable dignity, to one of the best apartments in the house, and leaving me in possession, retired with a bow to order a foot-bath and other luxuries, which she thought the exigencies of the case required. But the greatest compliment was yet to come. Some ladies, desirous of ascertaining the name of the eminent personage on whom so much attention was lavished, inquired who it was. The answer was given in a mysterious sort of whisper,—“*Das ist der Förster!*”

CHAPTER VIII.

THE PYRENEES.



THE PASSAGE OF THE PORT D'OO AND ASCENT OF
THE PIC DES POSETS.

THE PORTILLON D'OÖ, AND PIC DES POSETS.

BY CHARLES PACKE, B. A.

στείχοντα δ' αὐτόφορον οικεία σάγγη.

Æsch. Chœ. 675.

"And in thy right hand lead with thee
The mountain nymph, sweet liberty!" — ΜΗΤΩΝ.

A MOUNTAIN, whose height is only 11,047 feet, is but a pigmy to be set in the midst of the Alpine giants of Switzerland, and expected to do battle with them. Such as he is, however, I can find no better champion than the Pic des Posets to stand forward for the honour of the Pyrenees; and though he is not panoplied from head to foot with that ponderous armour of snow and ice, which protects, but also in some measure impairs, the beauty and symmetry of his Swiss rivals, his shoulder at least is mailed in glacier plate.

Of all the watering-places in the Pyrenees there is none which presents so favourable a *point d'appui* for expeditions to the higher mountains as Bagnères de Luchon, which, by the completion of a line now in progress from Tarbes to Montrejeau, will this summer be brought within three hours of a railway. Cauterets has its Vignemale and the Lac de Gaube; Gavarnie its Brèche de Roland, Mont Perdu, and that noble group of limestone mountains, which emulate the loftiest points of the granitic axis; but Bagnères de Luchon has its Port de Venasque, its Lac d'Oö, its Mala-

detta, and its Pic des Posets ; the last two (the Mont Blanc and the Monte Rosa of the Pyrenees) forming that offset from the principal chain, known as the Monts Maudits.

The landscape features of the lower regions of the Pyrenees are superior to those of the Alps ; the forests are greener, the streams more bright and sparkling, the sky more blue, and the rocks warmer and redder in their tints. There is a singular absence in the Pyrenees of that feature characterised by Mr. Ruskin as mountain gloom, but of mountain glory there is more than enough to compensate, whether we choose to watch the sunlit snows and serrated peaks from the soft turf of some secondary mountain, as the Antenac or Bacanère ; or, having worked our way over rock and glacier to one of the very highest pinnacles, to look down on the kingdoms of the earth, and the glory of them. It is true, that in the Pyrenees the glaciers do not stream down into the lower valleys close to your bed-room window, as in many parts of Switzerland. There are plenty of snow-fields, as well as glaciers, for those who like to explore them, even in the hottest summer ; but as they do not extend lower than some 9000 feet above the sea, to reach them from one of the principal watering-places is the work of half a day, and then it is time to return. To appreciate the Pyrenees thoroughly, it is necessary to pass some nights at a considerable elevation ; and of mountain accommodation there is woful lack. There are no scattered châteaux, for the inhabitants all live gregariously in the villages. Snug little mountain inns, such as those on the Riffel and Æggisch-horn, have not yet been established, and a night passed in a shepherd's cabane is an experiment few will care to repeat. The heat, however, in the summer of 1861 was so great * that it was really impossible

* Perhaps the hottest day of last summer in the Pyrenees was the 4th of August, on which day, at 3.18 P.M., the black bulb thermometer, inclosed in a vacuum tube and exposed on black wool to the full sun, with a S.S.W.

to inhabit the valleys with any comfort, and a considerable portion of the month of August (during which I was nominally resident at Luchon, and entered as such on the police registry) found me occupying sleeping quarters either in the auberge, on the borders of the Lac d'Oö, or in the cave on the Maladetta, known as the Rencluse, while not a few, and those not the least enjoyable nights were passed "*sous les belles étoiles*," generally, indeed, with the protection of my sleeping-bag, though on some few occasions I was unprovided with that luxury.

The auberge at the Lac d'Oö is a square stone building, that has been built within the last two years to replace the wretched hovel which, in the winter of 1858, was carried away by an avalanche. It is not quite thirteen miles from Luchon, and as it may be reached on horse-back, this is a favourite excursion of the French visitors, who resort here daily to discharge their expletives of "*beau!*" and "*magnifique!*" and to enjoy a *déjeuner* of the lake trout. None of these, however, remain to sleep, and after 6 P.M. I have always found myself left in quiet possession to contemplate and enjoy the scene.

Standing with your face to the south, before you lies the Lac d'Oö, a deep dark basin of cold clear water, fed by the overflow of the Lac d'Espingo and four upper lakes, and shut in on all sides, except the north, by precipitous rocks. On the far side of the lake, a magnificent cascade comes pouring down from a height of 866 feet, and is reflected in a white streak, extending half-way across the dark water. Though the largest of the Pyrenean lakes, the extreme length of this basin is little more than half a mile, and the time occupied by the boat in crossing to

aspect, attained 74·5° centigrade = 166° Fahrenheit. This was the highest I observed it to reach. On the same day and hour the plain thermometer in the shade marked 34·5° centigrade = 96° Fahrenheit.

the cascade is fifteen minutes. Under sunlight, or even cloud, a visit to the Lac d'Oo will always repay; but the most favourable time for appreciating this scene is on a fine summer's night, when the mountain-tops gleam cold in the moonlight, and the twinkling stars are mirrored in the tremulous waters. Many a night have I passed here: and sweet are the slumbers, when lulled by the roar of that cascade, which you may look upon even as you lie in bed.

Having passed a week of uninterrupted enjoyment at the Lac d'Oo, in exploring the magnificent scenery between that and the two uppermost lakes, the Lacs Glacé and Portillon, and in completing a collection of botanical and geological specimens, commencing at the village of Oo, 3051 feet, and ending at the top of the chain, 10,000 feet, above the sea, I wished to extend my wanderings beyond the Spanish frontier, and pay a visit, long meditated, to the Pic des Posets. I had hoped to have induced some friend to accompany me, but Pyrenean travellers, notwithstanding the milder climate, are, I am afraid, less disposed to rough it than those you meet in Switzerland; so at last, having summoned from Luchon my old guide, Pierre Barrau, and his brother Firmin, to act as porter, I resolved to set out alone.

It was a glorious morning when, on the 10th of August, 1861, we started at 6 A.M. from the Lac d'Oo. There was plenty for us all to carry; so I took my waterproof sleeping-bag (weighing 8 lbs.) upon my own shoulders, feeling that my enjoyment, when snugly tucked up in it at night, would be enhanced by the reflection that it had not been an additional burden to the rest. At 7.40 A.M. we reached the second lake, the Lac d'Espingo, height 6152 feet, where there is a cabane occupied by cowherds, who, during the two summer months, carry on the business

of cheese-making. This is the last human habitation ; and the lake also is the last containing fish, for, though fine trout are abundant in the lakes d'Oo and Espingo, the higher ones are too cold.

Twenty minutes after this we came to the third lake, the Lac Saousat (6381feet), and passed over some remarkable glacier-worn rocks. These rocks are only one of the many evidences of the ancient extent of the glaciers of the Port d'Oo and the Portillon, which seem once to have swept down this gorge as far as the village of Garin, on the northern flank of the valley of Arboust, and to have there formed a terminal moraine, conspicuous to this day. The numerous erratic boulders sprinkled over the hillside, though now resting on transition and other rocks, are themselves composed of that peculiar species of granite, with large oblong crystals of felspar, to be found *in situ* only on the mountains of the Port d'Oo.

The numerous lakes, of all sizes, abounding in those mountainous regions which more especially came under the influence of the glacial epoch—such as Scotland, North Wales, Canada, and Switzerland—are supposed by Professor Ramsay to be rock-basins, scooped out by the huge glaciers which overspread those countries at the close of the Pleiocene period. They are not mere fissures, and the strata forming their sides are never synclinal. According to this theory, the lakes of Geneva and Neufchatel are the results of the great ancient glacier of the Rhone ; the lakes of Brienz and Thun of the ancient Aar glacier ; the lake Constance of the ancient glacier of the upper Rhine ; Llyn Peris and Llyn Padarn of the Llanberis glacier ; and so with the rest ;—the lake being generally proportionate to the size of the glacier, and its bed deepest where the pressure of the superincumbent ice was the greatest. How far this

theory may be sufficient to account for such extensive sheets of water as the lakes of Constance and Geneva, Como and Maggiore, I shall not presume to offer an opinion; but the conformation of the Pyrenean lakes and glaciers seem to me to be completely in accordance with Professor Ramsay's theory. The chain of the Pyrenees running nearly east and west, and in a comparatively low latitude, the snows are unable to accumulate in sufficient quantities to resist the fierce heat of the sun on their southern side. In consequence of this, the existing glaciers of the Pyrenees, as well as the more extensive ones of an older period, of which we have abundant evidence in the *roches moutonnées*, and ancient moraines occupying the lateral gorges, were all situate upon the northern flanks of the mountains; and the lake basins, which are very numerous, though of no great size, are, with very few exceptions, found also on the northern flanks, and just in those spots where the traces of the ancient glacier are most conspicuous.

From the Lac Saousat the ascent is pretty rapid; and after leaving on our right a small fourth lake, the Coume de la Vache (6857 feet), and the tract leading up to the Port d'Oö, we followed the left branch of the stream to the Lac de Portillon, which we reached at 10.10 A.M. The scene here is magnificent, — glaciers streaming into the lake, and floating on its surface in broken icebergs. To the N.W. rises the abrupt pinnacle of the Tus de Montarqué, and resting upon this buttress, the snowy col of the Ciel de la Vache, separating the Lac Portillon from the Lac Glacé, is relieved in dazzling whiteness against the clear blue sky. Upon this col we saw seven izzards. At our approach they rapidly made off in the direction of the Port d'Oö, but they fled from us only to run into real danger; for two hunters had been stalking them on that side, and a shot, which we shortly heard,



THE PORT D'OÜ, PYRENEES.

rolled one of them over. This glacier is a favourite haunt of the izards during the heats of summer, and I have scarcely ever missed seeing them here. The height of the Lac de Portillon is 8695 feet above the sea, approaching the line of perpetual snow which on the north side of the central Pyrenees may be fixed at about 8900 feet; or about 700 feet higher than on the north side of the Alps.* After breakfasting at the lake, we crossed the stream by a snow-bridge, which, if it had happened to give way, would have let us in for something worse than a ducking, to judge by the thundering noise of the water beneath. A steep little slope of snow then has to be ascended in order to gain the ledge of rocks overhanging the lake on its eastern brink, which is very precipitous.

From the top of this rocky ledge you get a glimpse of a snowy col rising to the S.E., between the Pics Crabioules and Perdiguères, by which, on another occasion, I had passed over into the head of the valley of Litayroles, thence returning to Luchon by the Valley de Lys. Leaving this col on our left, our road lay first over some loose and slippery schists, and then, after crossing a rough moraine composed principally of granite blocks, similar to those at Garin, we reached the glacier; here we again came upon our friends the izards, within a fair rifle-shot, though it would not have been easy to have got down to the spot on which they were. A short distance across the glacier brought us to the Port, which is a slight gap in the chain

* The hottest period of the day I found to be at the Lac de Portillon between 12 and 1; while at Luchon the greatest heat was not till about 3 p.m.

In the course of several visits to this lake between July 24th and August 10th, I found the average maximum daily temperature at the Lac de Portillon to be about 50° Fahr. in the shade. At Luchon during the same period it was about 78° Fahr. The minimum at night registered during that period was 37° at the Lac de Portillon, 45° at the Lac d'Espingo, and 54° at Luchon. The weather during the whole of that period was perfectly cloudless, and unusually hot.

to the W. of the Pic de Perdiguères (height 10,564 feet). This Pic, though not quite 600 feet higher than the Port, is from it nearly inaccessible. On the S.E. side it may be ascended without difficulty from the Val de Litayroles. The height of the Port* de Portillon is 9987 feet (3044 metres), being the highest pass in the Pyrenees. And here at 1.30 p.m., about the hottest period of the day, with a perfectly cloudless sky, the thermometer stood at 50° Fahr. I had passed over this col the year before on August 22nd, and had left a bottle with a written memorandum, by which I see that the thermometer on that day at noon had marked 40.5°. On both these days the sky was absolutely cloudless, but on the last occasion it had continued so for many days. The vegetation was here limited to four species of plants,—the *Ranunculus glacialis*, *Hutchinsia alpina*, *Saxifraga greenlandica*, and *S. oppositifolia*,—which we found growing in the clefts of the rock. Looking northwards the prospect reaches as far as the Monnè, on the other side of the valley of Arboust; but its greatest beauty consisted in the striking contrasts of form and colour presented by the foreground; the sharp serrated peaks of the warm ruddy rocks, alternating with the undulating sweep of the white snow cols, were each of them relieved against the deep blue of the sky. Turning towards the south, you look full upon the Pic des Posets, with its red arching crest, like the comb of a game-cock, set up in defiance above the snows. The descent on the Spanish side is steeper than towards France; but there are no glaciers; and after traversing some snow-beds, too steep to be got over in a glissade, you come to a waterfall and stream, which, if followed, will bring you down to the Cabane de Turmes, in

* The word "Port" or "Portillon" is applied in the Pyrenees to passes over the main chain and "col;" "Hourque," or "Hourquette," to those over the secondary or transverse ridges.

the Valley of Astos, only three hours above Venasque ; but as I wished if possible to make our night bivouac on the mountain itself, and somewhat nearer the summit, we made our way as we best could over the rocks in a westerly direction, till we reached the gorge leading down from the Port d'Oo. The rocks here were so precipitous that we had some difficulty in effecting a descent. As we were beating about to find a practicable spot, two noble birds sailed over our heads, which we at once recognised as the *Gypaetus barbatus*, or bearded vulture, distinguished by the light tawny colour of its breast and neck, as well as by its superior size, from the ordinary Pyrenean eagle.* The sun's rays all this time were very intense ; and, after having overcome the difficulties of the descent, we decided upon a halt for refreshment.

Our stock of wine was carried in two skin bottles, with the exception of a solitary bottle of champagne, which Barrau had brought from Luchon, and which had already escaped such imminent risk of breaking, that I resolved not to give it another chance. Barrau, not at all unwilling to be relieved from his responsible charge, deposited the bottle in a natural wine-cooler formed by the stream, but had scarcely done so when a sharp report announced an involuntary libation to the water nymphs of the place. The bottle had burst into pieces, and the champagne was lost to me for ever ; but Barrau, with admirable presence of mind, immediately applied his mouth to a little runlet

* M. Lecoq, the Auvergne naturalist, has some splendid specimens of these birds brought from the Pyrenees in his museum at Clermont, which I had examined with some attention only a month before. The difference, if any, between the Pyrenean *Gypaetus* and the Lammergeier of the Alps does not yet seem to have been scientifically determined. Von Tschudi says that the Lammergeier of the Swiss Alps is larger than that which inhabits the Apennines and Pyrenees ; and it is not improbable that the feathery monarchs of Europe, like the huge Condor of the still mightier Andes, may bear some proportion to the size of their respective mountains,

just below the scene of the catastrophe, and, I believe, pretty nearly recovered his full share of the champagne, though probably in a more diluted state than he would have chosen.

The day now began to draw on, and it was evident that we should not make much progress up the mountain that evening; so we decided on a spot called the Cabane de Paoules, near the head of the Val d'Astos, at the foot of the Port de Clarabide (*Clara vista*), for our night bivouac. This we reached a little before 7 P. M., and I computed its height, by the sympiesometer, to be 6635 feet above the sea. The Cabane de Paoules is a peculiarly wretched and dirty specimen of those rude stone huts which are tenanted for two or three months by the shepherds on either side of the Pyrenees,—those on the Spanish side being the dirtiest, and their tenants more surly to strangers, especially to the French, between whom and the Spaniards there is no love lost; and the nearer the frontier the stronger is the mutual antipathy. The three padrones, however, whom we found here, were in no churlish mood, having that day recovered seven sheep which had strayed across the frontier, and which, if they had once got among a French fold, would have speedily been naturalised. Their rejoicing over the lost sheep was shown in their hospitality towards us. To their invitation of "*gusta, gusta*," and to the smoking cauldron of maize porridge, their customary supper, we did ample justice; but I had not carried my bag all day for nothing, and infinitely preferred it and the fresh air of heaven to the dirt and stifling air of their den. In a hole of this sort you are packed between your companions too closely to admit even of turning, and scratching, however irritated; and the fleas, unable to stomach the odours of garlic and other herbs with which the natives are impregnated, all the more ravenously devour the less highly sea-

soned flesh of a stranger whenever they get a chance. Let no traveller who means to explore the wilder parts of the Pyrenees omit to take a sleeping-bag.

The ground round the cabane was so stony that I was obliged to remove about 400 yards from the others, in order to spread my bag upon a bit of turf; and there, having made all snug, I was soon fast asleep. My slumbers were not, however, to endure uninterrupted, for towards midnight I was awakened by the sensation of some animal breathing upon my face, and, starting up with my alpenstock, four huge Pyrenean dogs recoiled from me just beyond its reach with a most ferocious barking. In the course of their nightly patrol these guardians of the fold had come upon me. They evidently had never seen a resuscitated mummy-case, and were quite as much startled at me as I was at them. Still they were not at all disposed to relinquish further investigation, and I was at last obliged to make my way as I best could to the outside of the cabane, where, on the hard angular stones, but under the protection of the dogs' masters, I passed the latter part of the night, not nearly so comfortably, but with more security.

It was our intention to make our attempt on the Pic des Posets by the gorge coming down into the head of the Val d'Astos,—a new route; and after some rather difficult scrambling up the rock, on which were growing some splendid specimens of the gigantic *Saxifraga pyramidalis*, we arrived at this gorge, where, close to the foot of the glacier, we found a flock of forty izards. They were frolicking about, and playing all sorts of pranks; and so intent on their sports, that for a long time they seemed unconscious of our proximity, as we watched them chasing each other about, and apparently engaged in a series of sham-fights. It is not yet, I believe, surely ascertained whether

or not the izard, the *Antilope rupicapra* of the Pyrenees, is quite identical with the Swiss chamois. In shape of the body, and formation of the horns, as well as in habits and extreme tenacity of life, the two animals are exactly similar; but the Pyrenean variety is, I think, slightly inferior in size. Of all the characteristics of an animal, the colour of the hair is the most uncertain, being liable to be modified by the season of the year, the nature of the food, and the age of the animal; still, as a general rule, the coat of the izard is of a redder brown than that of the chamois, and the under part of the throat and lower jaw, which in the chamois is white, in the izard is of a bright buff colour. The izards live gregariously in flocks of from four to sixty, and in summer are usually found on the eastern and northern sides of the mountains, coming down to graze in the early morning and evening, and betaking themselves to the snows and glaciers as a refuge from the midday heat. They partake in their nature more of the goat than of the antelope, and are not naturally shy or averse to man's society; but they have too well learnt that they are only brought into contact with him to their destruction, and they are generally on the alert for the approach of their greatest enemy. A loud angry hiss from one of the party, posted as scout, is the usual note of alarm; but on the present occasion they were unusually off their guard, and it was not till Barrau raised a loud whoop that they scampered before us up the mountain, showing, at any rate, that there was a way practicable to them, and I have little doubt that the top may be reached from this point in less than three hours; but here I found myself so unwell, either from an enormous bowl of sheep's-milk which I had taken before starting, or the preceding day's fatigue, that I was obliged to give in for that day. I had no faith in the pharmaceutical resources of Venasque,

and still less in the treatment of some Spanish Sangrado; but having reason to believe that there were neither Spaniards, sheep, nor dogs, at the Cabane de Turmes, I determined to give myself a day's rest, and make that my night quarters. The younger Barrau, Firmin, was despatched in advance to bring up a fresh supply of provision from the town of Venasque, while we leisurely followed down the right bank of the stream.

The Cabane de Turmes is lower down in the valley of Astos, by my computation 5511 feet above the sea, and about two hours' walking from that of the Paoules. It is a very convenient station, as there is an abundant supply of firewood close at hand, which is not the case at the Cabane de Paoules. We took up our position by the side of a large stone, and our preparations were completed, and a good fire blazing by the time Firmin returned with the fresh supplies. He had brought with him the materials for making some soup, viz., an earthenware pipkin and a piece of fat bacon, which, with water, slices of bread, and the addition of a little garlic, was compounded for me by Barrau with his usual culinary skill, ere he gratified his own national predilection in preparing, *à la brochette*, some luckless frogs that he had seized in the course of our saunter down the stream. Amid London delicacies this *potage au lard* does not sound appetising; but on the mountains I have always found it a most useful restorative, and a mess that one could always enjoy when overtired, and perhaps unable to swallow solid dry food.

The day's rest, and a hydropathic treatment in the Gave, to which I submitted myself in spite of Barrau's remonstrance, followed by an undisturbed night, in which I was well tended by "Nature's soft nurse," completely brought me round, and in the morning I was quite ready for a fresh start. The actual ascent of the Pic des Posets from

the Cabane de Turmes is long and not particularly interesting, as the route lies up the central gorge, hemmed in between two walls of rock that bound it on the north and south. The direction is first south-west, and then west. Across the central gorge rise transverse arêtes, forming four successive steps, and the comb or summit of the Pic springs from the glacier of the fourth. We started at 5.45 A.M., and, skirting on our left the Lac de Batticiel on the second plateau, at nine reached the lake on the north brink of the third plateau. Here we breakfasted. From this point forty minutes took us over some rough granite rocks, with a few plants of the *Gentiana acaulis*, the *Leucanthemum alpinum*, and the *Aster pyrenaicus* growing in the interstices. These specimens were the last vegetation that I noticed. Then came an hour over a gently inclined slope of snow and ice, across which we followed a numerous flock of izaras, probably the same that we had seen the preceding day, as they retreated before us down the other gorge to their old feeding ground. Beneath the fierce midday sun the frost-bound snows had started into life and motion, and the trickling of the numerous rivulets that interlaced the glacier fell on the ear like the warbling of many birds. The only difficulty we experienced in the ascent was in passing from the glacier on to the arête forming the actual summit; for the unusual heat of the summer had interposed such a yawning chasm between the ice and the rock, that the only spot where we could effect a crossing was in front of a very *mauvais pas*, just where the rocks were the worst. The central portion of the Pic des Posets is composed of granite; but this uppermost arête consists of that disintegrated clay schist, which is the prevailing rock in the central Pyrenees. It is doubly treacherous to the climber, being slippery as well as brittle; but twenty minutes' climb brought us up

this last wall. The summit consists of a narrow ridge running nearly north and south, the highest point of the mountain being nearer the southern extremity. It was 12.30 when we reached this. Another glacier rolls down the gorge to the westward, and beyond the fir-woods at the bottom you have glimpses of the yellow corn-fields above the Spanish village of El Plan. Those who have no experience of mountain climbing are unable to appreciate the exquisite pleasure, after toiling up the rocks for five or six hours, of arriving at the summit, and the agreeable sensation of seeing all around you.

" To stand upon some lofty mountain-top
And feel the spirit stretch into the view."

The infinite and the immutable, as poets in every language say, is reflected within ourselves, and associated with ideas of a superior order; but the human mind needs some tangible object from which to take its flight,— something present to lead it to futurity,— something bounded, whence to rise to the infinite. The blue vault of the heavens over head, sinking all terrestrial objects into absolute nothingness, might seem best fitted to awaken this sense of expansion in the mind; but mere space is not a perceptible object to which we can apply a scale, while the everlasting mountains spread out before us between heaven and earth, and met, as it were, on the confines of the region of fancy and sober reality, are here like written characters traced by a Divine hand, and suggest thoughts such as human language never reached.

" *L'esprit comprend ce que le corps domine;*" and I can confidently say that there is no spot in the Pyrenees that will compete with the Pic des Posets for a comprehensive view of all the higher summits, and their relative position in the chain. The Pic de Nethou, the loftiest

point of the Maladetta, is placed rather too much to the east; but from the spot on which we were now standing the central and highest peaks were spread out before us, as on a map. Pre-eminent in the west were the giant forms of Mont Perdu and the Vignemale, and beyond these the Pies du Midi d'Ossau, Baletous, Gers, and Gabisos. Then came the Neouvielle, conspicuous in the north-west, with the Pic du Midi de Bigorre seen over its



PIC DE SAUVEGARDE AND PORT DE VENASQUE.

shoulder. Full in front was a glorious view of abrupt mountains and snowy cols, from the Clarabide to the Perdiguère, and beyond this rose the menacing peak of the Sauvegarde, "*saxa acuta leto*," bringing sad reminiscence of an ascent made just two years before, when my companion, Archdeacon Hardwick, lost his life. To the right of this were the well-known Ports of Venasque and Picade,

and then came the ponderous mass of the Maladetta, with its crowning-point, the silver Pic de Nethou, marking 10° north of east. Looking southward the eye rested on the successive ranges of the barren mountains of Arragon; and beyond these in the distant south-west, I fancied I could recognise the blue outline of the Sierra de Moncayo, from the top of which, in the preceding year, I had enjoyed such a glorious spectacle of the solar eclipse.

The Pic des Posets was first ascended in 1856 by Mr. Halkett, and again in the same year by Mr. Behrens, since which, till 1861, it had not been revisited. My guide, Barrau, had been of the party on each occasion; but we could find no trace of the record left of the previous ascents. Not only the cards, but the stone cairn raised over them, had been swept away by the wind, or, as Barrau graphically expressed it, "*Le mauvais temps les a mangé.*" Upon these jagged storm-beaten rocks there was no trace of vegetation, not even the humblest lichen; though on the present occasion it was so warm that it was difficult to conceive we were at an elevation of more than 11,000 feet.

The thermometer marked 60° Fahrenheit. The boiling point I found to be 193.7 , and the sympiesometer, which at the Cabane de Turmes marked 24.30 inches, here stood at 20.33 inches. Having duly recorded all these details and deposited them in a small bottle under a rock, we were obliged to think of returning, and began to descend at 1.45 p.m. The snow slopes favour the descent; but there is a good deal of tedious rock to get over, and four hours at least should be allowed for the return. We walked at our best pace, only once halting for refreshment, and my customary afternoon bathe in one of the lakes, which I could not forego; but it was 6.30 p.m. when we reached the Cabane de Turmes, the point from which

we had started. A fire was soon kindled, and our stores and utensils, culinary as well as dormitory, being produced from the *cache* where we had left them, we were soon sleeping the sleep of innocence and health beneath the star-spangled canopy. During this, as well as the previous night, the temperature went no lower than 47° , so that the two guides, whose only covering was my plaid, were not at all to be pitied. In my sleeping-bag I have passed the night not at all uncomfortably, with ten degrees more cold and no fire. Starting the next morning at 5.15 A.M. we returned over the Port d'Oö to Luchon, which we reached at six that evening. The height of the Port d'Oö is 9846 feet (3000 metres), and the route passing by the Lac Glacé is exceedingly wild, though this pass, which is occasionally used by the Spanish shepherds, is neither so grand nor so difficult as that of the Portillon. We were only three nights out on this excursion; but I cannot help thinking that a week spent in an outing upon these mountains by a party of three or four travellers would amply repay.

As far as my experience goes, the chamois has become a scarce animal in the Alps; but each day here we came upon izards. They are not so much persecuted, and consequently are not only more numerous, but less shy, than their Swiss cousins. We did not often come upon them within shot, but a party of two or three might have stalked them without much difficulty. It was all I could do to restrain Barrau's ardour for the chase; although we had no gun he was always wanting to show me how near we could get to them. During the months of August and September, izards are constantly brought into the town of Luchon, where they are sold to the hotel-keepers for from fifteen to thirty francs.

The chasseurs only use buck-shot, so that they have

no chance unless they get within about fifty yards. A fair shot with a double-barreled rifle would no doubt meet with good success, as the animals are not yet accustomed to being knocked over at a long range. The bouquetin or ibex is now rarely seen in the Pyrenees, and I doubt whether a single one has been killed in the last three years. The lynx is pretty nearly, if not quite, extinct. Bears are sometimes found in the woods and killed, but more frequently during the winter than in summer. At any rate, of all deceptions practised upon the inexperienced traveller in the Pyrenees, the "*chasse à l'ours*" is the greatest and most unsatisfactory. Ptarmigan (*perdrix blanches*) are tolerably numerous on the less frequented peaks just below the snow-line, so that smooth bores ought also to be taken. In one of the lakes on the Pic des Posets there are said to be large trout, but they might prove insensible to the merits of an artificial fly. Those of the party who did not care for sport would find ample subjects to interest them in the unrivalled flora and magnificent scenery; and enjoyable indeed would be the reunion for the evening meal and the story of each day's adventures.

The head-quarters might be made either at the Cabane de Turmes or the Cabane de Paoules; whence the Spanish town of Venasque is within easy reach to fall back upon for fresh supplies of provision, or in case of the weather breaking up. In any case a retreat is always open to Luchon over the Port de la Glère or the Port de Venasque, as both these passes are practicable in all weather during the summer months,—the first only on foot, but the latter even on horseback.

There is little occasion for the ice-axe in the Pyrenees, and the glaciers are scanty and few as compared with those of Switzerland; yet that they are not altogether to

he ignored or despised, was sufficiently shown in an ascent of the Maladetta that I made a week later in company with a gentleman and four guides. Starting from the cavern of the Rencluse, the ascent from that point occupies good four hours,—the first two being over the rocks, and the last two over the Glacier de Nethou and the Pont du Mahomet. About three-quarters of the way across this glacier, just before reaching the foot of the dome, we sat down to rest in a spot where the snow was perfectly smooth. We were all roped together, with an interval of some ten feet between each; but there was a call for something to drink, and the last guide had detached himself to hand the wine-bottle to each of us. He was passing before us, and certainly not more than three yards from the spot where I was sitting, when he suddenly dropped through the snow and disappeared. There was no sound, neither cracking of the ice nor cry from the man,—a slight convulsive shuddering as he fell, and the glacier quietly swallowed up its victim. It was horrible to witness, but of course there was only one thing to be done. We speedily disengaged the rope from our bodies, and, carefully holding it in our hands, approached the hole, which was not large, my guide, Pierre Barrau, being the first. We let down the rope, and anxiously expected a reply to our shout. For some seconds, however, none came, and when it did come it sounded fearfully indistinct and distant, stifled as it was by the snow and walls of ice. The man fell, according to the guide's estimate, 18 metres (59 feet), but from the length of rope let down I should say about 30 feet. Thanks to the bed of snow that fell with him, and in which he was partly buried, the man was not hurt, and he was able to fasten the rope round his body, so that in about five minutes we drew him up, and a right hearty squeeze of the hand he interchanged with each of us. He was not much

the worse, but fearfully cold. He described his position as having been very perilous, having been caught on a ledge, below which sank a seemingly unfathomable abyss; but in this he may have exaggerated. However, the man himself, whose name is Corrége, showed plenty of courage and presence of mind, and all the guides behaved very well, so that it was unanimously decided to continue our course to the top, which we all reached, with the exception of one of our party,—a French gentleman,—who declined passing the Pont du Mahomet, a short but precipitous arête of rock, between the glacier and the actual summit. Here, at a height of 11,168 feet, at 10 A.M. the temperature of the air in the shade was 42° Fahr. On a previous ascent the year before, at 9 A.M. the thermometer had only marked 22°. I had left a minimum registering thermometer, in the hopes of ascertaining the extreme cold of the winter, but it had been swept away by the wind.* The sympiesometer marked 20·27, and the boiling point was 193·3. This was the third ascent I had made of the Maladetta, which, being the highest of the Pyrenees, as well as more accessible to Luchon, is much better known than the Pic des Posets, being sometimes ascended even by ladies.†

The Pic des Posets, however, is only 120 feet lower, and, as a point of view, decidedly superior.

All travellers, but most of all mountain explorers, have

* In the winter of 1857, 1858, a minimum thermometer left by Mr. Lezat reached 24·2° Centigrade = 11·7° below zero, Fahr., while in the plain at Toulouse the extreme cold only reached — 7·5° centigrade = 1·8° Fahr.

† The summit of the Pic de Nethou was first reached July 20th, 1842, by MM. Tehihatcheff and De Franqueville, with the guides Argaro, Redounet (dit Nate), and Bernard Ursule. The sleeping quarters at the cave of the Rencluse are seven hours from Luchon over the Port de Venasque. The way is now so well known that, with the usual precautions, there is no danger, and there has been no fatal accident on this mountain since the year 1824, when a guide named Barrau, a great-uncle of my guide, disappeared in a crevasse on the Maladetta glacier, and no trace of his remains was ever afterwards seen.

some prejudices in favour of the haunts with which they are best acquainted. In Switzerland there is greater scope for feats of mountaineering; but for the real enjoyment of a summer tour, to my mind there is no place like the Pyrenees.



MALADETTA FROM THE ANTENAC.

There is scarcely a spot in the Pyrenees that is not accessible to a moderately good walker, without paying the penalty of having the eyes blinded and the face scarified by a continuous march of many hours over snow; while the higher peaks are just of that elevation, from 10,000 to 11,000 feet above the sea, which is admitted to be most favourable to a mountain prospect, provided you are not overtopped by higher mountains. For the less enterprising, there are the ports and secondary peaks, which may nearly all of them be reached on horseback. Excellent little horses, both for the mountains and the road, may be hired for a moderate price in all parts

of the Pyrenees. Guides are to be had in abundance, from the noisy indolent rascals, who excel chiefly in cracking their whips at the head of a cavalcade of French ladies and gentlemen, to the serviceable fellow who does not grumble at being asked to carry your knapsack and to use his own legs. Among these there are some few with a really good local knowledge, though seldom extending beyond their own district, who not only may be trusted as pioneers over the mountains, but when the day's work is done, will also be found cheerful companions and useful aids in preparing the bivouac "*al monte*."

NOTE.

The gorges and mountains around the Lac d'Oo especially deserve the attention of the botanist. In rising from the village of d'Oo to the frontier chain, the plants present almost a complete epitome of the flora of the central Pyrenees, especially if you include the two lateral valleys of Medassoles and Esquierry, which are justly celebrated as the *Jardin des Pyrénées*. Each plant is confined to its peculiar zone, with such regularity that, from a few specimens, it would not be hard to estimate the elevation within a thousand feet.

The following is a list of some of the principal plants which I found in the neighbourhood of the Lac d'Oo:—

3000 ft. to 5000 ft. above the sea.

Aconitum Napellus (purple-flowered monkshood.	Helleborus viridis.
Antirrhinum sempervirens.	Hyoscyamus niger.
Aquilegia pyrenaica.	Hypericum nummuloïdes.
Aspidium fragile.	Meconopsis cambrica.
Astrantia major.	Scrophularia Scorodonia.
Cistus Helianthemum.	Solanum Dulcamara.
Digitalis ochroleuca.	Spiraea Ulmaria.
Euphrasia lutea.	Teucrium Scorodonium.
Galeopsis Ladanum.	Valeriana pyrenaica.
Geranium phœum.	Vicia pyrenaica.

5000 ft. to 6000 ft.

<i>Bupleurum angulosum.</i>	<i>Ramondia pyrenaica.</i>
<i>Centaurea montana.</i>	<i>Reseda glauca.</i>
<i>Eriophorum Scheuchzeri.</i>	<i>lutea.</i>
<i>Gentiana lutea.</i>	<i>Saxifraga adscendens.</i>
<i>Hepatica triloba.</i>	<i>Aizoon.</i>
<i>Lilium Martagon.</i>	<i>caespitosa.</i>
<i>Meum athamanticum.</i>	<i>pyramidalis.</i>
<i>Myrrhis odorata.</i>	<i>umbrosa.</i>
<i>Oxalis Acetosella.</i>	<i>Scabiosa columbaria.</i>
<i>Pinguicula flavescens.</i>	<i>Thalictrum Candollei.</i>
<i>Polygonum viviparum.</i>	<i>Veratrum album.</i>
<i>Potentilla alba.</i>	<i>Viola biflora.</i>
<i>alchemilloïdes.</i>	<i>cornuta.</i>

6000 ft. to 7000 ft.

<i>Aconitum lycoctonum</i> (white-flowered Monkshood)	<i>Helianthemum alpestre.</i>
<i>Alchemilla pyrenaica.</i>	<i>Homogyne alpina.</i>
<i>Allium Schönoprasum.</i>	<i>Juncus arcticus.</i>
<i>Allosorus crispus</i> (Parsley Fern).	<i>Lonicera pyrenaica.</i>
<i>Anemone alpina.</i>	<i>Orchis nigra.</i>
<i>Angelica pyrenaica.</i>	<i>Parnassia montana.</i>
<i>Arnica montana.</i>	<i>Phyteuma hemisphaericum.</i>
<i>Artemisia.</i>	<i>Polygala angustifolia.</i>
<i>Aspidium Lonchitis</i> (Holly Fern).	<i>Rhododendron ferrugineum.</i>
<i>Asplenium septentrionale.</i>	<i>Rosa pyrenaica.</i>
<i>Astrantia minor.</i>	<i>Salix pyrenaica.</i>
<i>Colchicum autumnale.</i>	<i>reticulata.</i>
<i>Doronicum scorpioides.</i>	<i>Saxifraga aizoides.</i>
<i>Erica Tetralix.</i>	<i>stellaris.</i>
<i>Eriophorum capitatum.</i>	<i>Scabiosa succisa.</i>
<i>Geum montanum.</i>	<i>Silene ciliata.</i>
<i>Gnaphalium dioicum.</i>	<i>Tofieldia palustris.</i>
	<i>Trifolium alpinum.</i>

7000 ft. to 8000 ft.

<i>Azalea procumbens.</i>	<i>Poa alpina.</i>
<i>Dryas octopetalon.</i>	<i>Primula integrifolia.</i>
<i>Empetrum nigrum.</i>	<i>Ranunculus alpestris.</i>
<i>Erigeron alpinus.</i>	<i>gracilis.</i>
<i>Gentiana verna.</i>	<i>gramineus.</i>
<i>Gnaphalium Leontopodium.</i>	<i>Thora.</i>
<i>Juzula spicata.</i>	<i>Scutellaria alpina.</i>
<i>Pedicularis pyrenaica.</i>	<i>Seseli montanum.</i>
<i>rostrata.</i>	<i>Soldanella alpina.</i>

8000 ft. to 9000 ft.

Androsace carnea.
Arenaria ciliata.
Aster pyrenaicus.
Cardamine alpina.

Gentiana acaulis.
 nivalis.
Leucanthemum alpinum.

9000 ft. to 10,000 ft.

Cerastium latifolium.
Draba Wahlenbergii.
Hutchinsia alpina.
Liularia alpina.
Oxyria reniformis.
Ranunculus glacialis.

Saxifraga nervosa.
 oppositifolia.
 groenlandica.
Statice Armeria.
Veronica alpina.

1. EXPLORATIONS ROUND THE FOOT OF MONTE VISO.

BY WILLIAM MATHEWS, JUN., M.A.

“Das Mögliche soll der Entschluss
 Beherrscht sogleich beim Schopfe fassen.”—*Faust*.

THERE is no town in Italy which commands so magnificent a panorama of the chain of Alps as Turin. The wide plain on which it stands, with its sea-like surface broken into undulations by ranges of low hills, crested with copses and sparkling villas, rolls many a league around, until it is suddenly interrupted by the mighty rampart which encircles it in a horse-shoe curve 250 miles in length. Many noble peaks rise at intervals along the ridge; northward are the dazzling snows of Monte Rosa and the Lyskamm, and in the S.W., where the great chain approaches nearer than elsewhere, it towers up into the rugged pinnacle of Monte Viso, the ancient Mons Vesulus, one of the most precipitous and striking mountains in Europe. The streets in Turin are straight, and cross each other at right angles; stand where you will, and look in any direction excepting eastward, and some portion of the Alps closes in the vista. In one of the quarters of the city half of the streets open out towards Monte Viso, so that it is almost constantly in view, and stands like a giant sentinel, sleepless, immortal, keeping guard over the kingdom at its feet.

It was about the date of the Christian era that the capital of the Taurini, the modern Turin, was made a

Roman colony under the name of Augusta Taurinorum. From that time the Mons Vesulus must have been familiar to the Romans; but it is not a little singular, considering the number of the military roads they had even then made across the Alps, that it should be the only peak of importance known to them by name, or at any rate of which the ancient name has been preserved. It is, indeed, stated by some modern writers that Mons Silvius was the Latin name of Monte Rosa, but I know of no classical authority for this assertion.

We first read of the Mons Vesulus in Virgil, who speaks of its pine-clad sides as the resort of the wild boar —

“Ac velut ille canum morsu de montibus altis
Actus aper, multos Vesulus quem pinifer annos
Defendit,” . . . Æn. x. 707.

The next author by whom it is mentioned is Pomponius Mela, the first Roman geographer, who probably composed his work “De Situ Orbis” in the reign of the Emperor Claudius. He writes (lib. ii. cap. 4 § 4):—*“Padus ab imis radicibus Vesuli montis exortus, parvis se primum e fontibus colligit.”* Mela is followed by Pliny, who repeats the statement that the Viso contains the sources of the Po, and adds that it is the highest mountain in the Alps:—*“Padus e gremio Vesuli montis celsissimum in cacumen Alpium elati, finibus Ligurum Vagiennorum, visendo fonte profluens.”* — *Historia Naturalis*, iii. 16, § 20.*

More than eighteen centuries have passed away; day by day men have watched it crimson flushed at sunrise, and in

* I am indebted to my friend Mr. F. E. Blackstone, of the British Museum, for referring to the original works for the passages from Mela and Pliny.

the evening seen it standing out with clear-cut profile against the western sky; quarters of cities and streets innumerable have been named after it; astronomers have determined its latitude and longitude; engineers have measured it at a distance; geographers have pretended to map it; even Englishmen have travelled round it; but up to within the last two years no attempt has been made to set foot upon its summit. I could, indeed, fill pages with quotations, in which every form of superlative which the word inaccessible is capable of receiving has been lavished upon this terrific peak, by writers who seem to have regarded its precipitous contour rather as an excuse for inaction than as a spur to enterprise.

A brief preliminary description of the portion of the chain which culminates in the Viso will render the narrative part of this paper more easily understood. The peak itself is built somewhat in the form of a bayonet, by the union of three ridges of rock. Suppose these, in the first instance, to radiate from a common centre; turn one of them round until it is in the same straight line with one of the other two; and a rough conception of the architecture of the mountain may thus be obtained. This will be made plainer by a reference to the annexed diagram, where *o* is the summit, and *o A*, *o B*, *o C*, the three ridges which unite to form the peak. These are not equal in size and importance, but *o A* greatly preponderates, and may be considered as the main mass of the mountain, with *o B* and *o C* as supporting buttresses. The Viso, although very near the watersched, which separates Dauphiné from Piedmont, is not on the actual crest of the chain, but projects in front of it, like the advanced work of a fortification; the dividing ridge, which runs in a southerly direction as far as the point *c*, there taking a broad sweep to the westward, and leaving the mountain standing entirely upon Italian

ground. The faces of the peak on almost every side are awfully precipitous, those within the space A O B being

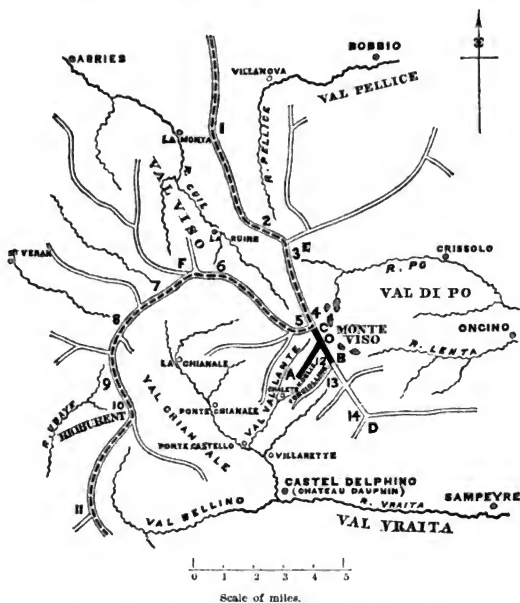


DIAGRAM OF MONTE VISO AND ADJOINING MOUNTAIN RIDGES.

Boundary between France and Italy, - - - - -

O, Grand Viso.

A, Petit Viso.

COLS.

- | | | |
|------------------------|-----------------------|----------------------------|
| 1. Col de la Croix. | 6. Col de la Ruine. | 11. Col de Lantaret. |
| 2. Col de Seylières. | 7. Col dell' Agnello. | 12. Col delle Sagnette. |
| 3. Col de Traversette. | 8. Col de St. Verant. | 13. Col di Costa rossa. |
| 4. Col de Coulaon. | 9. Col Longet. | 14. Col di San Chiaffredo. |
| 5. Col de Vallante. | 10. Col du Loup. | |

somewhat less so than the others; and it is here in the very angle that kind Nature has built a staircase to the summit.

Four great valleys have their origin in or near the spurs of Monte Viso. The ridge *B o c* is prolonged nearly in the same line northwards to *E* and southwards to *D*, and at these two points subordinate ranges are thrown out towards the *E.*, which enclose the valley of the *Po*, and separate it from the *Val Pellice* on the *N.* and the *Val Vraita* on the *S.* At *Château Dauphin* the latter valley forks, and the northern branch, with its numerous tributaries, occupy the western side of the ridge *B c*. The upper part of the *Val di Po* is also divided, but by hills of comparatively small elevation,—the river which flows along the southern arm bearing the name of *Lenta*. The *Val Pellice*, the *Val di Po*, and the *Val Vraita*, are Italian, and open into the plain of *Piedmont* at *La Torre*, *Saluzzo*, and *Venasca*. The remaining valley, the head of which occupies the angle *E c F*, is French, and is watered by the river *Guil*. It pursues a north-westerly direction from its origin to *Abries*, where it turns at right angles, and finally joins the valley of the *Durance* at *Mont Dauphin*. Above *Abries* it is called the *Vallon de Viso*, below it the *Combe de Queyras*. It will be observed that the valley of the *Po* is remarkably broad and square-headed: the *Viso* is consequently conspicuous in almost every part; in the other valleys, on the contrary, it is generally invisible, excepting from its actual base.

Monte Viso is usually considered as the terminal peak of the *Cottian chain*; the *Val di Po* being the most southerly valley in that division, and the *Val Vraita* belonging to the *Maritime Alps*. Notwithstanding its great height of upwards of 12,500 feet, it gives rise to no glaciers, partly on account of its low latitude ($44^{\circ} 39' 45''$), and partly because the higher portions of the mountain are too precipitous to retain the snow. There are, however, among the lofty ridges in the vicinity many beds of snow, which

are subject to great fluctuations in extent, according to the character of season and the time of year.

The best maps of the district are Bourcet's map of Dauphiné (1749—1754) for the French side, and for the Italian side the six-sheet Sardinian Survey, and sheets 57 and 63 of the large 91-sheet Government Map. There is also the "*Carte Topographique militaire des Alpes*" of Raymond (Paris, 1820), the Dauphiné sheet of which embraces both sides of the Viso. I am indebted to Professor Forbes for the loan of it, and I think a traveller would probably find it more useful than the others. All the maps are, however, more or less inaccurate and unsatisfactory.

I first visited the mountain in 1860, when I approached it on the French side. I had been spending some time in the neighbourhood of the Grand Pelvoux with the Rev. T. G. Bonney and Mr. J. C. Hawkshaw, the latter a young mountaineer of nineteen, one of the most energetic and skilful climbers I have ever had the pleasure of travelling with. Our only regular guide was Michel Croz of Chamounix, who before we entered Dauphiné had been with me in the Tarentaise. Our Pelvoux campaign, owing to the unrelenting cruelty of the weather, had been a series of disasters; but we hoped to retrieve our fortunes on the Viso, and it was not without deep thankfulness that we anticipated a speedy release from the inconceivable filth and vile food of Dauphiné.

Late on the evening of Saturday, the 19th of August, we drove down the main road from L'Abessé to Mont Dauphin, where the Guil joins the Durance, and rounding the fortress ascended the valley of the former river as far as Guillestre. This is a considerable town, and the principal inn, the *Hôtel des Alpes*, tolerable for Dauphiné, but dear. Being much in want of rest, and the following day being

Sunday, we determined to pass the next night at Abries, a drive of from five to six hours, for which we engaged a carriage on very reasonable terms.

At 9.30 on the morning of the 19th we quitted Guillestre by the road which ascends the Combe de Queyras, passing, at starting, an interesting church with a handsome porch of three arches, supported by very slender pillars resting on lions. The columns are constructed of a mottled red marble, occurring in some abundance in the vicinity. Just outside the town the road mounts rapidly, and commands a superb view of the range of the Pelvoux, which we saw with tantalising clearness. The sky was cloudless, and the brilliancy of the day made us fondly imagine that at last the weather had changed for the better, and would enable us to achieve success.

The scenery of the Combe above Guillestre is very striking, and we enjoyed our drive exceedingly. The road winds for some distance along the river-side at the bottom of a gorge, walled in by steep and red-tinted cliffs, then suddenly mounts on the right, so as to cut off an angle. On gaining the eminence we looked down upon the wider valley beyond, in the very centre of which, perched upon a lofty isolated crag, stands the highly picturesque fortress of Château Queyras. We rested a quarter of an hour in a queer little inn in the village near the foot of the fort, where we were supplied with far better food than we expected, and then resumed our journey. Above Queyras the scenery changes and becomes very tame, the valley being wide and flat, and the road so bad that it was only occasionally that the horse could be pushed into a trot. We reached Abries at 3.30 P.M., and drove into an open square in the middle of the village, which was occupied by groups of people dressed in their Sunday attire, with some of whom the Curé and his

clerical brethren were indulging in a game at bowls. The principal inn, l'Étoile, *chez* Richard, stands on the east of the square, and its outside had rather a promising appearance. On entering, we found the two eating-rooms on the ground floor filled with drunken peasants, sitting in groups of twos and threes, simultaneously screeching at one another in an incomprehensible *patois* of the most harsh and barbarous description, with an accompaniment of frantic gesticulations. After dining in the midst of this tumult, we retained the services of one Joseph Peyras as extra guide, and instructed Michel to see to the packing of two days' provisions, to be conveyed on muleback to the highest châteaux. These arrangements completed, our host conducted us to our chambers, solemnly pledging himself that we should start at 4.30 in the morning.

The style of our bed-rooms will be better understood if I first describe the method generally pursued in Dauphiné for getting rid of offal. After any meal, the plates are scraped in the eating-room and the broken victuals thrown upon the floor. The dogs of the neighbourhood then investigate the débris and devour what they can of it, leaving the bones behind. As brooms are entirely unknown, a geological formation of offensive character is soon accumulated. We had become so accustomed to this, that the state of the *salle* we had dined in did not disturb us; but when we went upstairs we found, to our horror, that the same process had from time immemorial been going on all over the house. The floors of our bed-rooms were covered with a layer of bones and dirt several inches thick, and all the accessories were in perfectly harmonious keeping. Three weeks' experience had tolerably hardened me against the attacks of more than one species of nocturnal enemy, of which I am convinced Dauphiné was the original centre of dispersion; but my companions were more sensitive:

they passed a highly animated night, and entertained me on the morrow with a history of their sufferings, the details of which I will not inflict upon my readers. The sum we were charged for our board and lodging was not much less than it would have been at the first hotel in Turin.

Notwithstanding the promise of an early start, it was 6.30 A.M. on the 20th before we got away from Abries. As the char road goes some distance farther up the valley, Richard had harnessed his mule to a covered cart, and he persuaded us to get inside. At Abries the main valley bends at right angles, and extends in a south-easterly direction to the foot of the Viso, the line of the Combe de Queyras being continued above the village by the Val Prévaire, at the head of which there are passes into the Vaudois valleys of Germanasca and Pellice. The cart jolted so abominably that we were soon afoot again. On reaching La Monta, where a second route into the Val Pellice by the Col de la Croix diverges to the left, it could go no further; so the provisions and knapsacks were taken out and packed upon the mules' backs, we in the mean time walking on before. The valley above Abries had hitherto been uninteresting; but a fine rocky peak now appeared in front. We pronounced it to be the Viso, and were immediately at work with our sketch-books, feeling some contempt for it all the time, as it appeared very easy. While thus busily engaged the remainder of the party came up, and our local guide, Peyras, told us, to our disgust, that we were altogether mistaken. At 9.20 A.M. we reached the highest châteaux in the valley, the Bergerie de la Ruine, situated on the left bank of the Guil, at the foot of a path leading by the Col de la Ruine into the Val Vraita. The name has probably been given from a great fall of rocks which has taken place in the vicinity, to which several enormous

blocks of talcose schist lying in the middle of the valley below the chalets doubtless owe their position. A few years ago there were some rude stone cabins nearer to the Viso, but they are now in ruins. We unloaded the mule, paid and dismissed Richard, seated ourselves upon the grass for breakfast, and discussed our plans with Peyras. This worthy had at first informed us that he had made the ascent of the Viso and knew the way up, but it appeared on cross-examination that he was speaking of a col; and when we explained to him that our object was to get upon the top of the peak, he regarded us as downright madmen. We supposed the col he spoke of to be the Col Viso described in Murray, and stated to command a superb view of the plain of Piedmont. We resolved to mount the col and examine the terrain, and attack the peak on the morrow. We were, however, in no hurry to be off, until the tenant of the chalet brought us on to our legs at once by telling us, that unless we reached the col by noon we should see nothing, for the mountain would be certainly clouded,—a prediction which seemed strange, as the weather at the time was perfect.

We started at 10.30 A.M., and recrossing the Guil followed the ascending path, which now mounted rapidly, diverging from the gorge through which the river rolled below us on the right. We soon gained the comparatively level track above, and in a moment stood face to face with a scene of the wildest and most striking character. Immediately in front of us is the Viso at last, that is, the north-western flank of the great ridge of *o A*, seamed with deep ravines and snow-filled couloirs, and crowned by a line of square-topped towers and turrets, of which the two most remarkable occupy the extremities of the summit ridge. The one on the left is the highest peak, that on the right is an immense cubical block known as the

Petit Viso. Bounding the valley on our left, and connected with the Viso, a long and lofty ridge, with its crest cut into a thousand jags, separates us from the valley of the Po. The savage wildness of the mountain view is still more striking from the gentle beauty of the foreground. Up to the very foot of the crags roll undulating sweeps of uncut mountain pasture, even now so bright with blossom that in the early summer they must have been a paradise of flowers. *Anemone narcissiflora* in profuse bloom, thick as buttercups in an English meadow, whitens the hillside; the blue spikes of the rare *Campanula spicata*, and the yellow heads of *Senecio Doronicum* are detected among the waving grass; while high above it the beautiful *Delphinium elatum*, a far more elegant and stately plant than our common garden larkspur, lifts its long and slender panicle of flowers.

A rough general idea of the Viso, as seen from the French side, may be gathered from the frontispiece to this paper, which has been reduced from a plate in Tayleur's Dauphiné, and corrected from sketches by Mr. Bonney and Mr. Hawkshaw. The face in view was extremely precipitous,—in fact the mountain looked like a second Matterhorn on a somewhat smaller scale, and I think we all entertained serious doubts as to the possibility of climbing it. One method only seemed to offer the smallest chance of success, and that was by cutting steps up the very steep snow-slope on the left, and so gaining the foot of the final peak. Some gently inclined beds of snow appeared to lead up to the base of the steep slope, and just on the right of the former, according to Peyras, lay the Col de Viso we were making for. On my asking him if that were not the position of the Col de Vallante, he replied that the two names referred to the same pass. We determined accordingly to push on as fast as possible

to the col, to ascend thence to the point where we proposed to commence step-cutting on the morrow, and thoroughly reconnoitre the ground that lay between it and the summit.

Just on the point of noon, an ugly mass of brouillard sailed up from Italy, and perched itself in the gap above the Col de Vallante. It increased with alarming rapidity, and in a few minutes enveloped the whole mountain in an impenetrable cloud. We pushed on for the col, hoping that it would disperse, climbed up upon the right of a great pile of broken rocks, and put our feet upon the snow and our heads into the mist nearly at the same moment. A few steps in advance and we stood upon a ridge, with the Val Vallante below us, and all but about ten feet of it perfectly invisible. It was now 1 o'clock, and we loitered about in hope of seeing something more than the very dim outlines of the different members of the party. At 1.20 P.M. I observed the barometer; and a comparison with Turin gives an altitude of 9365 feet. Ten minutes more pass away with no prospect of a break; we are shivering with cold, and the condensing moisture is decidedly unpleasant; so we turn our faces in the supposed direction of the summit of the Viso and begin to mount the snow. After a climb of half an hour, a gust of wind dashes through the clouds, and we get a glimpse of our position. Just in front is a rugged peak, on the crest of the ridge dividing us from the valley of the Po, and a little to the right of it is the steep snow-slope we are anxious to examine. But they are sundered from one another by a fearful rift, perhaps 1000 feet deep, upon the brink of which we are standing, and of which we cannot see to the bottom, as it is filled with cloud. The walls of the chasm being nearly vertical, a descent into it is not attempted: Michel and Hawkshaw go forward to

scale the peak in front, Bonney stays to observe the barometer, and I climb some rocks close at hand. It is interesting to note the height to which vegetation ascends in the vicinity of the Viso. The barometer observation gives an altitude of 9998 feet, and the crag I mounted was about a hundred feet higher. On its summit *Pyrethrum alpinum*, *Saxifraga exarata*, and *Armeria alpina*, were growing abundantly, and a closer inspection would probably have disclosed several other species.

Hawkshaw and Michel having returned from their investigation and reported further progress impracticable, and the mist having closed in again rather thicker than before, we descended to the col with the determination to cross it on the following morning, and work up the bottom of the ravine, which we judged must extend from the head of the Val de Vallante to the valley of the Po, and entirely cut off the Viso from France. Descending on the northern side, we were soon below the cloud again, and, having plenty of time on our hands, scrambled among the pile of rocky fragments, and brought our hammers into play. Many of the blocks are mica schist, but here, as on all other sides of the Viso, rocks rich in magnesia seem to predominate. Fragments of serpentine, chlorite, and talc slate were quickly transferred to our pockets, together with specimens of an olive-green fibrous mineral, somewhat resembling asbestos, which we found in large quantities. On our return to La Ruine we had occasional glimpses of the Viso through openings in the clouds, and once caught sight of a herd of eight chamois upon a patch of snow not far below the summit.

We regained the châlet early in the evening, and found it one of the most agreeable mountain resting-places we had ever stayed at. It was tenanted by an oldish man named Jacques Roche, whose wife lived there with him,

which rather surprised us, as the charms of feminine society are a very unusual addition to the pleasures of an Alpine bivouac. The worthy couple were most civil and obliging, and did all in their power to make us comfortable. If I were again to visit the Viso from the side of France I should lay in my provisions at Guillestre, and make an early start from that place, dine, and perhaps change horses at Queyras, and push on the same day to La Ruine, thus avoiding the filth and high charges of Abries.

Our supper was delayed until a late hour, in consequence of the goats not coming home until long after the usual time. Until their arrival we could get no milk, and they were quite indifferent to the vociferations of Roche, who rushed out every ten minutes and apostrophised them as brigands. In the mean time our plans for the morrow were warmly debated, and we discussed what we should do if, as seemed highly probable, the bad weather should continue.

Above La Ruine there are three passes across the eastern barrier of the Guil valley into Italy. The first of these is the Col de Seylières, leading into the Val Pellice. Next to this is the Col de Traversette, which is the usual route taken to the lakes at the head of the Po, and thence to Crissolo. Through the ridge below this col is an ancient tunnel called the Traversette, the history of which will be found in Murray. Still farther on, and nearer to the Viso, is a higher col immediately above the sources of the Po. This is called in Bourcet's map the Col de Coulaon, and in sheet 57 of the 91-sheet Sardinian Survey it bears the singular title of the "Passo del Color del Porco." The Val Pellice being the nearest way to Turin, we determined to make our passage into Italy by the Col de Seylières; and the goats having at last arrived, we supped, and retired to rest in the corner of a most commodious hay-loft, where we

should doubtless have slept soundly but for the unceasing music of the goat-bells.

We were up betimes on the morning of the 21st, but the state of the weather was decidedly unsatisfactory, there being a good deal of cloud in the direction of the Viso. We delayed a couple of hours, hoping it would disperse, but as it showed no inclination to do so, we packed up our knapsacks, and quitted the bergerie at 6.45. On arriving at the upper pastures, the mountain was completely shrouded; we consequently bore up to the left, and at 8.45 were standing upon the Col de Seylières, and looking down into Italy.

The arm of the Val Pellice, which is connected with the col, is nearly parallel to the Vallon de Viso, descending directly to the N., and turning eastward some miles down near the village of Villa Nova. There is therefore no distant view, and indeed we could see little more than some long and steep snow-slopes immediately beneath us. At 9 I observed the barometer, and a comparison with a simultaneous reading at Turin gives an altitude of 9247 feet. The rocks in the immediate vicinity, which are composed of mica schist, were by no means deficient in vegetation. Within a few yards in extent I gathered *Petrocallis pyrenaica*, *Thlaspi rotundifolium*, *Saxifraga bryoides* and *Aizoon*, *Aronicum Doronicum*, *Artemisia glacialis*, and a *Campanula* about two inches high, which I cannot distinguish from the common harebell of our English hedges, — a tolerably full list for so great an elevation.

We started upon our downward course at 9.30, having previously made a re-distribution of the various articles of baggage, by which our only remaining bottle of wine was assigned to Hawkshaw's pocket. The snow was in delightful order for glissading, and we dashed down it with

shouts of delight, greatly to the astonishment of Peyras, who had never seen anything of the sort before, and, not having a spiked pole, was very clumsy in his movements. Many of the slopes originated high up on the side of the valley to our left, and we in our descending course hit them one by one somewhere near the middle. This, however, would not do for Hawkshaw, whose appetite for the amusement was insatiable, and who persisted in climbing up to the top of every one of the slopes before beginning to *glisser*. He had just reached the summit of one of the highest, and was about to descend, when he tripped up, and commenced his slide on his back head foremost. Suddenly the precious bottle darted out of his pocket, and came dancing down the snow, executing a series of the most graceful somersets. A shriek of horror at once issued from the lips of the other members of the party: I made a rapid flank movement, and happily captured the truant in its wild career, while Hawkshaw, having speedily righted himself, completed his slide in a more dignified position.

Having traversed some extensive tracts of red snow, and passed rocks covered with rhododendron bushes in a blaze of crimson blossom, we arrived at 10.45 at the highest pastures, and lay down on the grass by the side of the crystal stream to take our mid-day meal.

The spot was so attractive that it was 12.15 before we resumed our journey, and began to descend through exquisite valley scenery, which, had it but a snowy background, would rival that of the Val Anzasca or the Val de Lys. Our path first leads us along a plot of mountain pasture fringing the river-side, and then by sharp zigzags down a steep gorge, walled in by noble crags and strewn with vast fragments of rock, among which the torrent foams and tumbles; a little farther, and the valley bends eastward, and we look for many a mile along it, from the

vine-trellised houses of Bobbio at our feet to where, in the distance, it opens out into the plain of Piedmont. Below Bobbio the bounding ranges recede and leave broad strips of fertile land on either side the river, and we walk by many glorious walnuts, and through pleasant chestnut groves, until we come in sight of La Torre, the most important town of the Vaudois valleys. I have preserved no note of the time at which we reached this very picturesque place, but I think it must have been about 4. Having paid and dismissed Peyras, we dined, and took a carriage to Pignerol, arriving just in time to catch the last train to Turin, where we found at the Hotel de l'Europe a very different kind of lodging from that we had enjoyed the previous night at the bergerie of La Ruine.

I stayed several days at Turin in order to make amends for former discomfort, and for the first and last time in my life was heartily glad at getting out of the Alps. I had been travelling among them for three weeks, and had only had four fine days : I had slept nearly every night either in a chalet or in a filthy inn, and had scarcely tasted the whole time what could be fairly called a dinner. My two friends went to Zermatt by way of the St. Théodule, taking Michel with them, while I spent the remainder of my holiday at Verona and Venice.

On my arrival at Turin, I found a letter from my friend Mr. Ball, with whom I had had some conversation in the early part of the year respecting the best route to the summit of the Viso. Mr. Ball wrote from Novara on the 30th of July, and informed me that he had been travelling a few days previously in the immediate neighbourhood of that mountain, and that although continued clouds kept him entirely in the dark for the first two days, a fortunate break on the morning of the third day revealed the true way to the top. Mr. Ball ascended the valley of the Po

to Crissolo, went into France by the Traversette, and out again by the Vallante to Château Dauphin. The path from the latter col passes close to the extremity of the ridge o A (see diagram); and on turning this point Mr. Ball obtained what he terms an entirely new view of the mountain, viz. the south-eastern face of that ridge. Along this face, which is far less precipitous than any other part of the Viso, he conceived that the summit might be reached, especially as there was a quantity of snow upon it, which would greatly facilitate the ascent.

Unhappily, I did not receive this letter in time to enable me to turn the information to account in 1860, but I carefully treasured Mr. Ball's advice, and reserved the Viso for the crowning expedition of the subsequent year's campaign.

2. ASCENT OF MONTE VISO.

"Das Mögliche soll der Entschluss
Beherzt sogleich beim Schopfe fassen."—*Faust.*

ON Tuesday, the 27th of August, 1861, I was again at my old quarters at the Hotel de l'Europe, in Turin, in the company of my friend, Mr. F. W. Jacomb, and with our guides, J. B. and Michel Croz. What a different season from the previous year! The sky had been unclouded for weeks, and for five months not a drop of rain had fallen in Turin. The only drawback to such charming weather was the haze which the excessive heat had gathered over the Italian plains.

I spent the afternoon in making a careful comparison of my barometer with the standard instrument at the academy, which is placed in a small room on the roof. The building being very high, there is a most superb view from the top, comprising the whole of the city, the plain of Piedmont, and the great chain of Alps. Monte Viso was perfectly clear, and I confess I was not surprised, as I looked at it, that climbing it should have been so long considered a hopeless task. The annexed woodcut from a sketch by my friend, Mr. Tuckett, is an accurate outline of Viso as seen from Turin.

Anxious to lose not a moment of the brilliant weather, we resolved to commence our expedition the following morning, and, bearing in mind Mr. Ball's instructions, to make Château Dauphin, in the Val Vraita, the starting-

point for our ascent. We quitted Turin at 5.15 A.M. on the 28th by the first train, going along the Cuneo railway as far as Savigliano, and then by a branch line to Saluzzo, where we arrived at 7.17, having spent nearly the whole of the time in looking at the Viso out of the carriage



MONTE VISO FROM TURIN.

window. Breakfast was now the first consideration, and on our inquiring for an inn, we were directed to the Albergo della Corona Grossa, by Emmanuele Garabello. I am happy to be able to speak in the highest terms of the *cuisine* at this establishment, and only regret that Jacomb, feeling unwell, was unable to pay it that attention which

it deserved. He looked on, however, with great good-nature while I disposed of his share of the breakfast in addition to my own.

While thus engaged we sent for a vetturino, and made inquiries from him as to the possibility of taking a carriage up the Val Vraita as far as Château Dauphin. He told us that the road was not practicable beyond Sampeyre, from which place we had better walk, and that we must take a two-horse carriage, for which his charge would be twenty-five francs. My notion of the distance to Sampeyre was very indistinct; but being in Italy, I thought I could not do wrong in hazarding an opinion that he was asking us too much. Upon this, the vetturino terminated the discussion in a very unexpected manner, by indignantly wishing us good morning, and leaving the room in an instant. As he did not reappear, we were under the necessity of sending the waiter to tell him that we accepted his terms, and begged that he would get the carriage ready as soon as possible. The instructions were speedily complied with, and at 9 o'clock we were travelling *en grand seigneur* through the streets of Saluzzo. This place stands near the extremity of the mountain range which divides the valley of the Po from that of the Vraita; and, being on its northern face, it was necessary for us to round the terminal buttress before getting into the latter valley, which may be said to commence at Venasca, a town about half-way between Saluzzo and Sampeyre. The Val Vraita is the first of the Italian valleys of the Maritime Alps, and has a character altogether different from its more northerly neighbours in the Cottians. Below Sampeyre the bounding mountain ranges stand far back from the river, and leave a wide plain at the bottom of the valley, ornamented with clustering groves of walnut, interspersed with larch and poplar, and cultivated by means

of constant irrigation. High up the mountain sides the eye seeks in vain for those refreshing slopes of green pasture which form so charming a feature in the scenery of the Swiss Alps, and rests instead upon endless red lines of arid crag, almost devoid of vegetation. There is, however, a marked difference between the two sides of the valley, the trees growing much more freely upon the southern side, which has, of course, a directly northern aspect.

The road was so bad that, although Sampeyre is only twenty miles from Saluzzo, we did not reach it until 1.30, after a hot and dusty drive of four hours and a half. We went to the "Hôtel de la Croix Blanche," I suppose the principal inn of the place, where we found tolerable quarters of a rough description; and after taking some refreshment, we lay down in the shade of a great walnut outside the town, until the heat was sufficiently abated to admit of our walking with comfort. We started again at 4, and, having plenty of time before us, strolled quietly up the valley to Château Dauphin (Italian, Castel Delfino), distant about seven miles from Sampeyre, and which we reached at 6.20. It is stated in the last edition of Murray that there is a char road all the way, and probably there once was a good one. We found it, however, in many places so much out of repair that I should not recommend any traveller to attempt to get a carriage along it.

Castel Delfino is 4340 feet above the sea level, and is charmingly situated at the head of the Val Vraita, in the midst of beautiful Alpine scenery. Close to the village the main valley branches into two, continuing in a south-westerly direction as the Val Bellino, and in a north-westerly one as the Val Chianale, the Rioburent (11,053 feet), the highest mountain in the Maritime Alps, occupying the intermediate angle. The Val Bellino communicates with the Val Ubaye in Dauphiné, by the Col de

Lautaret and other passes; while the Val Chianale gives access to a series of lofty cols, leading into France across the ridge connecting the Viso with the Rioburent. About two miles up the Val Chianale, the Val de Vallante branches out of it towards the N.W. near the village of Ponte Castello, beyond which is Ponte Chianale, and further still La Chianale. From the latter village there are routes to the Vallon du Viso and Abries by the Cols of Ristolas and La Ruine; to the Combe de Queyras, by the Cols of Agnello and St. Véran, and to the head of the Val Ubaye by the Col de Longet. All these passes are probably more than 9000 feet high; they are at present almost unknown to English travellers, and deserve further exploration.

The inn at Castel Delfino bore the sign "Au Château Dauphin," and was kept by an old blind man named Joseph Antoine Rua. We had been interested to notice the change in the language of the people in ascending the Val Vraita. At Saluzzo Italian was spoken, at Sampeyre it was replaced by Piedmontese and a little French, and at Château Dauphin French appeared to be the native tongue of the inhabitants. Our quarters were not first-rate, but they might easily have been worse. We were supplied with a decent supper in a room to ourselves, and should have been tolerably comfortable, but that our blind landlord made himself a great nuisance. The poor old fellow had half lost his wits, and wandered backwards and forwards into our room in a bewildered manner, saying that we must have patience, for we were in a "*pays de montagnes*," a phrase which he was never weary of repeating. While supper was in preparation, one of the natives came and told us that he knew a guide who had made the ascent of the Viso, and that if we liked he would go and fetch him. By the time we had finished the messenger reappeared with Matthieu Rousse, the guide in question, who

asserted that he had made the ascent, "*même jusqu'au pied de la montagne!*" On our explaining that the top and not the bottom of the peak was the point we were aiming at, he and Rua burst out into a chorus, of which impossible, inaccessible, frightful precipices, madness and death, formed the principal burden.

Our plan was to start early the following morning with provisions for two days. On the first day we proposed to walk up to the highest châteaux, leave our knapsacks there, and make a preliminary survey of the mountain, returning to the châteaux to sleep: on the second we hoped to scale the peak, and on descending to cross the ridge into the valley of the Po. It was therefore important to us to ascertain the position of the most convenient sleeping-place, and of the col by which we might best effect the passage into the adjoining valley. Repeated questionings failed to elicit from Rousse anything more definite than that we must cross into the valley of the Po by the Col de Costa Rossa, and that that route was incompatible with going to the châteaux,—a statement which I could not understand. In the mean time old Rua became insufferably garrulous, and he and Rousse and the messenger all talking at once made such a Babel of voices, that we were obliged to close the discussion, and instruct Rousse to be ready next morning to take us by the nearest cut to the foot of the Viso, when we would ourselves determine what course we should pursue. Having given directions for the preparation of the provisions, we turned into bed; but did not get a good night's rest, as our two Chamounix guides and several members of the household slept in the same room.

On the morning of the 29th we were stirring soon after 4; but I thought we should never have got away, as old Rua opposed a passive resistance to our various demands for necessary articles of food, and indeed Jean and

Michel had almost to seize, by main force, the provisions that were wanted. Veal was the only meat to be got, and when we asked for hard-boiled eggs we were told they had none, which I did not believe, as we had eaten omelettes both for supper and breakfast. At last I thought everything was ready, when Michel came in with a very long face. "Monsieur," said he, "I am very sorry, but we must go away without wine." "Nonsense," I replied,— "it's ridiculous, —we have just finished a bottle, and I have no doubt there is plenty in the house." "True, Monsieur," he rejoined; "Rua says we may take as much wine as we choose, but he refuses to let us carry away the bottles, and we can find nothing else to put it in." As want of wine would have been a most serious deprivation, I was obliged to argue the question with Rua, who represented truly enough that he had very few bottles in his possession, and would be obliged to send many miles down the valley to get another supply. Happily I coaxed him into selling us as many as we wanted, and while the wine was being stowed into a knapsack, Michel, who was of an investigating turn, discovered a store of eggs, and insisted upon staying to boil them, which occasioned another delay. We finally started at 6.45, having, I believe, made a nearly complete clearance of the eatables in the auberge.

Our guide, Matthieu Rousse, quitted Château Dauphin by a path along the Val de Chianale, and on arriving at Villarette, turned off to the right, and led us up the mountain spur which intervenes between that village and the Val de Vallante. After ascending a few minutes we entered a pleasant forest of Scotch and Arolla pine in about equal proportions. The trees of the latter were thick with fruit, and many cones lay strewn about with the kernels eaten out by squirrels. Between the trees the ground was carpeted with the finest turf, which, earlier in the season,

may probably afford good botanising, but which was now parched up and devoid of vegetation, except where it was covered in places by a thick growth of bilberries, crowded with ripe and luscious fruit. Strolling quietly upwards, we reached the crest of the ridge, consisting of a knoll, surrounded by an open space of greensward, and had at last our long-expected view of the great mountain, which stood immediately before us.

From our standing point we looked across a deep valley straight up the angular space $\angle AOB$, with the ridges OA and OB on either side of it, the former, as in the view from the French side, crowned by a row of square-topped crags, divided from one another by deep and narrow fissures. Along the base of the crags lay the route Mr. Ball had indicated, but every particle of snow had now disappeared. The final peak, which presents itself on this side as a huge cloven rock, was by no means promising; but the way to the foot of it was so gently inclined, and seemed so easy, that we could scarcely resist a feeling of disappointment. It was but 8.30, we had nearly the whole day before us, the châteaux were just at the foot of the mountain in the Val de Vallante, and it seemed a pity to tie ourselves down to return to them at nightfall. After the long-continued hot weather, it was hopeless, except in the early morning, to expect an extended view of Italy, and I therefore proposed to Jacomb that we should abandon our original plan, make the ascent that day, and pass the night upon the summit. The weather was extremely fine; my companion had a plaid, which the guides had been dragging about for some weeks, and which might now be made serviceable; and after the nocturnal bivouac by the side of the great Aletsch with the Rev. Leslie Stephen, the incidents of which were fresh in my recollection, I had no fear of the consequences.

The proposition was eagerly accepted, and on being communicated to the guides merely elicited the answer, "*Eh bien, Monsieur, nous sommes aussi forts que vous.*" We lingered on the knoll until 9, and then bade Rousse steer straight for the châteaux. Leaving on our right the path to the Col de Costa Rossa we descended into the Val de Vallante, walking among scattered pines and across grassy slopes, intersected by ravines, and dotted with moss-covered boulders. We soon emerged into the open pastures, and at 9.50 arrived at the highest Alpine settlement in the valley. This is situated at the extremity of the main ridge of the Viso, which divides the Val de Vallante from a tributary valley on the S., called on the large Government Map the *Vallon delle Forciolline*, the châteaux being just above the point of junction. As I understood Rousse, the spot is called Pierre Meyer, and is doubtless the same as Pian Meyer of the map,—a name which occupies a slightly different position.

Anxious to husband our provisions, we availed ourselves of the resources of the châteaux, and as we had plenty of tea with us we brewed some, and made a meal upon tea and bread and butter. We endeavoured in the meantime to extract some geographical information from the herdsman, whose astonishment at learning we intended sleeping out upon the mountain I shall not easily forget. Our position commanded the valley of the Forciolline, and a gap in the chain at the head of it, marked on the map as the Passo delle Sagnette. On our inquiring whether we could cross it, he said that chasseurs went over occasionally, but that it was very difficult, and that the other side was horrible,—all rolling stones. Matthieu Rousse being now of no further use, and not exhibiting the faintest desire to join in our expedition, we sent him about his business, and at 11.40 we quitted the châteaux and commenced our upward

journey, having previously (11.30) taken a barometer observation, which gives the following results :—

	Feet
Turin	6552
Geneva	6594
St. Bernard	6460
Mean	6535

After leaving the pastures, our way led us through a magnificent forest of Arollas, which clothes the foot of the mountain on the side of Forciolline, and which afforded us most grateful shade. Beyond it we came upon rocky slopes strewn with fragments from the crags above, at the base of which we walked until we had passed the foot of the cubical mass called the Petit Viso. A little further along are two mountain tarns fed by a stream, which dashes down a wide rock-strewn valley on the left. This valley offered so inviting a route that we at once turned into it, fully expecting that it would land us very near the summit of the mountain. At 2.30 we stayed for dinner by the side of the stream, and after an hour's rest recommenced our climb. Crossing a snow-filled hollow from which the water issued, we scaled a steep rocky wall above it, gained the ridge at 5, and were at once greeted by the peaks of Dauphiné.

We were, however, far enough from the top of the mountain, with no chance of arriving there that night, if indeed any further progress were at all practicable. We were standing upon one of the numerous serratures of the ridge, about midway between the Petit and the Grand Viso, the now familiar form of the latter peak towering up 1400 feet above our heads, and cut away from us by one of the deep gorges which are so peculiar a feature in the architecture of the mountain. The ridge, extending from the summit to the Col delle Sagnette, presented an outline of extraordinary character, being carved into jagged pin-

nacles of the most fantastic forms. The accompanying woodcut, taken from a rough sketch made upon the spot, gives a general idea of this part of the mountain. The two halves of the deeply-cloven rock on the left appeared to us of equal altitude, but the left-hand one was the nearer of the two, and is considerably lower than the other,—the real terminal peak,—which was found to be also double-headed.

We at once decided to camp where we were, and sent Michel forward to explore the gorge. He descended into



SUMMIT OF MONTE VISO.

it without difficulty, and we soon saw him mount a great snow-slope on the face of the opposite ridge and arrive in one of the gaps at the head of it. He returned to us after an absence of about an hour and a half, with the information that the precipices on the side of the valley of the Po were nearly vertical, and that the actual line of junction of the two ridges was the only route which offered the slightest prospect of success.

Although our desire of passing the night upon the highest pinnacle of the Viso had been frustrated, we had

happily reached a camping-place which commanded a panorama of wonderful extent and sublimity, upon which we never tired of gazing. The widely-riven crags above us in the immediate foreground interrupted a considerable portion of the northern horizon, and masked the summits of Savoy and Switzerland; but in other directions there was no such obstacle. In the W. the sun, rapidly marching downwards, glowed fiery red above the many ranges that radiate from the Grand Pelvoux,—an almost unknown region, thickly clustered with lofty and unfamiliar peaks, which I failed to identify, and the relations of which to one another I was quite unable to unravel. They formed, indeed, what some writers would call a confused mass of mountains,—truly, perhaps; but the confusion is in the mind of the spectator, and exists only because he has not yet acquired the key to the scheme of the Almighty Builder. Southwards we looked over the numerous Italian valleys of the Maritime Alps, and followed the sweep of the main range nearly to the Colderi Tenda. The eastern portion of the scene was a striking contrast to the remainder. Beyond the jagged ridge of the Viso we had before us the valley of the Po, partly lying in dark shadow, and opening out into the plain of Piedmont. The view on this side, beautiful as it was, was somewhat disappointing. White fleecy clouds clustered over the plain, affording only glimpses of the towns and rivers in the intervals between them, and at sunset they united into an impenetrable covering.

The evening shadows have gradually been lengthening, and wrapping in their dusky folds one by one the valleys at our feet, and the great plain is illuminated by the warm yet subdued light of the declining sun. Suddenly the apex of a black triangle is projected upon the plain, the darkened surface gathers size every minute,

and with swift strides marches majestically eastwards: it is the shadow of the Viso. "What a pity we are not upon the top," is the exclamation of one of us: "we might, if we were, see the spectre of the Brocken." From the apex of the shadow shoot out broad diverging rays of light, very similar to those seen in the sky when the sun shines through openings in the clouds. We stand intently watching this singular spectacle, until the plain darkens rapidly, and the last segment of the sun's disk sinks like a burning coal behind the snows of Dauphiné. The ray-crowned shadow was a phenomenon as striking as it was unexpected: it may perhaps have been caused by the light shining through some of the numerous clefts by which the summit of the mountain is rent, and producing illuminated spaces in the broad penumbra which surrounded the shadow; but I cannot offer this as an entirely satisfactory explanation.

No sooner had the sun disappeared and ceased to add to the warmth of the earth's surface, than the work of restoration commenced, and the store of heat accumulated during the day-time began to escape into space. The height of our camping-place, by an observation made at 6 P.M., was 11,249 feet (Turin 11,268, Geneva 11,256, St. Bernard 11,222). As it was exposed to a whole hemisphere of unclouded sky, radiation went on rapidly, and a sudden shiver creeping over us warned us to make arrangements for the coming night. A meal of meat and wine supplied us with a stock of fuel for the production of animal heat, and, supper ended, we turned our attention to the arrangement of our bed. Nook or cranny or overhanging rock to mitigate the influence of radiation there was none, and all that we could do was to descend a few feet on the side of Forciolline, and so obtain shelter from the slight westerly

wind that blew gently across the ridge. Nor were we able to discover any slab of stone that might serve us as a mattress, for the mountain in nearly every part is thickly covered with fragments of rock, and we were obliged to content ourselves by arranging a series of blocks in such a manner that the angular points they presented upwards should be as few as possible. These preliminaries completed, I put on, underneath my wide-awake, a light travelling-cap that protected the ears, and donned a comforter and a pair of warm gloves, and Jacomb, having spread his plaid out on the stones, he and I lay down side by side upon the half of it, and covered ourselves over with the other portion; Jean and Michel meantime disposing of themselves after their own devices on some rocks close at hand.

No mountaineer can be considered thoroughly initiated into the mysteries of Alpine travel until he has experienced the sensations of a nocturnal bivouac on some lofty peak. The sense of solitude and isolation from mankind, the deep and solemn silence, the wonderful canopy of heaven, black as jet, inlaid with stars shining with a piercing brilliance, of which the dwellers in the plains can form no conception, and revealing the vague and ghost-like outlines of the many peaks around, produce upon his mind an indelible impression, and make him feel almost as if he were standing at the portal of another world. We looked, as we lay, at the summit of the Viso: above it was the pole star, and along its left-hand edge the limbs of the Great Bear. A few hours after sunset a blood-red flame flashed up in a gap in the riven crags before us; it was the rising moon; it floated upwards like a fire-balloon, and sailed away into the sky. But for one trifling drawback we might have realised Wordsworth's beautiful lines —

“ The silence that is in the starry sky;
The sleep that is among the lonely hills.”

Sleep, unhappily, was impossible: whenever I moved I disturbed the blocks beneath, and a stony dagger darted into my back. In the next place, the temperature was by no means agreeable. Although a pair of Alpine minimums exposed upon the rocks, when examined in the morning, stood no lower than freezing, I felt the cold acutely, and at times my very stomach shivered. Once or twice I rose and sought relief in exercise, but I found the absence of the protecting plaid make a perceptible difference; and I fear the guides must have suffered more than we did, as they had nosuch covering, and roamed about uneasily almost the whole night. Ultimately I found it best to lie as still as possible, and I whiled away the time by watching the stars glide one by one past the eastern edge of the peak, and calculating by the decrease of their hour angles the nearness of the dawn. Comfortless as it was, we would not have exchanged our stony bed for the softest couch in Europe.

At last the long-expected sign of relief appeared in the eastern sky. As, however, little else than rock-work lay before us, it was essential to have plenty of light, and it was not until 4.20 on the morning of August 30th that we broke up our encampment. We descended into the gorge and mounted the opposite snow-slope, but instead of going on to the crest of the ridge, as Michel had done, we bore away to the W. up the left hand branch of the slope, as shown in the woodcut. The sunrise had been completely invisible, owing to the thick haze which still brooded over Piedmont, and we did not catch sight of the luminary until he had mounted well above the fog, and shot down his rays upon us with a fierceness which fully compensated for the coldness of the night. The passage from the snow to the rocks was attended with some little difficulty, but was soon effected, and after a steep climb beyond, we arrived at 6.20 A.M. at a cliff, down the face of

which were trickling some slender rills of water. This sight immediately suggested the propriety of breakfast, and we managed to spend an hour very pleasantly in the enjoyment of that agreeable meal. Even now we had only just regained the altitude of our camping-place, so that, including the unnecessary ascent of the previous evening, we had incurred three hours of useless labour by our ignorance of the mountain.

At 7.20 A.M. we were off again, and, rounding the cliff, found a steep couloir, which we scrambled up. This was succeeded by a face of rock, and this again by a small patch of snow, and then another couloir, and so on. Slowly and surely we mounted upwards, always following the easiest lead, with only a general notion of the position of the summit, as we could never see more than a few feet in advance, but keeping the eastern precipices near us on the right. Occasionally we made diversions to the edge of them, and tried to catch sight of the lakes of the Po; but we only succeeded in peering down into tremendous rents, which here, as on all other sides, cut into the heart of the mountain.

The climb, though excessively steep, was not very difficult, as the rocky juts and corners on which we placed our hands and feet afforded tolerably firm support, and were quite free from ice. If any portions of the peak had been glassed over, as they easily might have been earlier in the year, or in a less propitious season, the ascent would have been a very different matter. One danger, indeed, we had to contend against, and it demanded incessant vigilance. Loose blocks of all shapes and sizes lay along the couloirs, stood poised upon pedestals, or rested insecurely upon sloping faces of rock. Keeping in close file, we disturbed the fragments as little as possible, but notwithstanding all our precautions, masses of several hundred weight were

occasionally dislodged in front, and came whizzing down in fearful proximity to the heads of the men in the rear. Once, indeed, I only saved my face at the expense of several pieces of flesh torn from one of my hands; and shortly afterwards Jacomb was nearly lamed by a large slab falling on his foot.

Nearly two hours have passed away since we left our breakfast place, when Michel, who is first, gradually mounts in advance and suddenly stands still. "*Il a gagné la cime,*" cries Jean, who is behind me. We shout up to him to know if it be true. "*Je le crois bien, Monsieur,*" is the reply; "*mais il y en a encore une autre, un peu plus loin.*" I struggle fiercely upwards, with Jean and Jacomb close behind, and in a few moments we are standing by his side and gazing into boundless space. It is 9.20 A.M.; we are on a flat rock-strewn ridge, which has the same direction as the line o a of the diagram; before us is another similar and parallel one, connected with the first by a curving arête of snow, interrupted here and there by rocks. We have no instrument with us to determine which is the higher: there cannot be many inches' difference. The upper sky is one unbroken vault of glorious blue; our standing place is the loftiest summit within a radius of forty miles, and not one of the innumerable snow-peaks in the N. and W. is dimmed by the faintest trace of a cloud. We look round upon the view. Let us begin with Monte Rosa, distant, as the crow flies, just 100 miles. It looks somewhat smaller than we have been accustomed to regard it; but all its details are clearly distinguishable. There is the Col de Lys, the Lyskamm, and Castor the taller of the Twins, and there, too, the Col des Jumeaux, which we crossed a few days before. To the left of Castor the horizon line is continued by the well-known forms of the Breithorn and the Matterhorn, but farther on, the outlines of the Pennine

range are undistinguishable, as they are either hidden or mixed up with the much nearer eastern Graians, among which the Grand Paradis is the most prominent. To the left of the latter we recognise the Grivola, followed by a slight break, and then by the immense mass of Mont Blanc, loftiest and noblest of the snowy range, and especially dear to our two friends from Chamounix. Its summit is forty-five miles distant from Monte Rosa and eighty from the Viso. Turning directly westward we have before us the superb cluster of the Alps of Dauphiné lying between the Durance and Romanche, with scores of graceful peaks, all waiting to be climbed except the Grand Pelvoux, vanquished by my friend Mr. Whymper a few weeks previously, and which I cannot certainly identify. To a superficial observer, they present the most attractive features; but I know only too well the horrors by which they are encompassed. The portion of the panorama between this region and Mont Blanc is of somewhat inferior interest, the most conspicuous object being an elevated snow-field, with a black pyramid in the centre. This I believe to be the Dent Parrassée above Thermignon in the Maurienne, surrounded by the vast glacier which crowns the range between Entredeux-Eaux and Pralognan. We now turn southwards, and experience our first disappointment. I had always expected that the summit of the Viso would command the Mediterranean, but we look along the sweep of the Maritime Alps, and search in vain for the smallest glimpse of sea. All along their summit ridge lies a dull flat-topped purple grey cloud-bank, obstructing any further view.

The prospect eastward, though of surpassing beauty, is not altogether satisfactory. At our feet are the chain of lakes, the highest sources of the Lenta and the Po. We follow the rock-bound valleys until they merge into the Italian plain, where we trace the course of the Vraita, the Po,

and the Pellice, shining like silver threads among the towns and villages, until they unite their streams into a broad river and roll together towards Turin. Strain our eyes as we will, the city is invisible; and indeed Pignerol is the farthest town we can distinguish. How much our range of vision is curtailed by the thick haze with which the plain is shrouded, may be inferred from the fact, that Monte Viso is, in clear weather, a conspicuous object from the top of the Duomo at Milan, where it is seen at a distance of 115 miles.

Marred as it was, the whole scene was one of extraordinary loveliness, and stands foremost in my recollections as the most wonderful and impressive spectacle I have ever beheld in the Alps. Whether the Mediterranean could be seen under more favourable atmospheric conditions is somewhat doubtful. The nearest point of the coast line is at Ventimiglia, near Nice, sixty-seven miles distant, and a line drawn from the Viso to that point crosses the main Alpine chain, forty miles from the Viso, to the W. of the Col di Tenda. I do not know the height of the chain here, but if so great as 9,500 feet, the view of the sea would be intercepted. If visible at all, it would most probably be in the direction of Savona. This town is seventy-four miles from the Viso, and the Alpine ridge behind it is almost close to the coast, and of no great elevation. Some traveller, in making the passage from Genoa to Leghorn, or *vice versâ*, may perhaps solve the converse problem.

Being in doubt as to the rival claims of the two summit ridges, it became a matter of duty to reach the farther one, which was soon done, with little additional result in the way of prospect than the sight of the Col de Vallante and the upper valley of the Guil. Having built a stone man upon it, we retraced our steps, and while the two guides were constructing a similar erection upon the

first ridge, Jacomb and I turned our attention to the barometer. The mean altitude deduced from comparisons with Turin, Geneva, and St. Bernard, is 12,668 English feet. The indications of the instruments, the method of calculation, and the determinations of previous observers, will be found in a hypsometrical note at the end of the paper.

The second stone man completed, we placed an Alpine minimum thermometer, No. 301, in a hole near the base of the northern face, and secured it by brass wire to an angle of one of the stones. At the time of its insertion it registered 8.0° Cent.

We could with pleasure have spent hours upon the top, but it was necessary to think about getting down again, and at 11 we commenced the descent, having first secured some specimens of the summit rock. This consists of a schist of foliated chlorite and quartz, which, when freshly fractured, is of a greenish grey. The older exposed faces, as indeed the whole surface of the mountain, had a ruddy tint, owing to the conversion into peroxide of protoxide of iron in the chlorite. The percentage of chlorite in different parts of the mountain is very various, and in some places so small that the rock is little else than quartz.

Our downward journey was easier than the upward, and we amused ourselves immensely by dislodging the blocks, sending them flying into space, and hearing them dashed into splinters below. Much discretion was necessary before venturing to tread upon one, lest it should topple over: once I was completely upset, happily with no worse result than a badly bruised shin. I examined on the way several of the extraordinary serratures of the south-eastern arête. The rocky substance of the mountain appears to be intersected by several systems of vertical joints, and these to be traversed by a series moderately inclined to the horizon. Pinnacles built of blocks, placed one on the top of another,

result from this structure. The annexed woodcut represents a very striking one. The frosts of the coming winter would probably lay it prostrate; and the constant destruction of such prominences in a similar way easily accounts for the multitude of fragments with which the mountain is laden.

We regained our breakfast-place at 12.50, picked up the knapsacks which had been left there, and made straight for the bottom of the gorge below us. Michel went on in ad-



A PINNACLE OF MONTE VISO.

vance, as usual, and before long was seen climbing the rocks towards the Sagnette. Jacomb was obliged to descend very slowly, in consequence of an injury to his shoulder occasioned by a previous fall, which had obliged him to carry his arm in a sling, even during our scramble of the preceding day. I drew away gradually from him and Jean, reached the base of the col at 2, and at 2.20 joined Michel, who was lying down and smoking. He had examined the descent, and pronounced it practicable. Far down below were two shining lakes, the sources of

the Lenta, and in the distance a charming view towards Barges and Pignerol. It was nearly half an hour before the other two came up, and as we had eaten very little since our 6 o'clock breakfast, we determined to dine on the grass by the water-side, and to get there as soon as possible. On the eastern face of the col is a precipitous couloir covered with loose shale and stones. We stuck our heels into the disintegrated substance, and detached a small avalanche of it, in the midst of which we slid downwards until it became unmanageable, and then, stepping on one side, we let it roll away. A repetition of this operation about a dozen times brought us on to some steep grass-slopes below; we ran down them, and gained the lakes at 3.15. The descent from the col cannot be less than 1000 feet.

The satisfaction we felt at success so far beyond our first anticipations, joined to a keen appetite, gave a great zest to our dinner; we enjoyed our meal immensely, and demolished every particle of the remaining provisions. At the foot of the Viso, on the eastern side, lies a band of nearly level plain. Just under the peak it is somewhat narrowed, and here a flat watersched divides the drainage of the Lenta from that of the Po. The streams flowing from the highest lakes of the two rivers inclose between them a group of hills, and unite into a common channel just below Oncino. After an hour's halt the propriety of moving was indisputable, and we started off, intending to follow the waters of the Lenta. Beyond our resting-place the plain was entirely strewn with blocks of rock from the size of a dining-table downwards, and the water did not flow from the lakes in any perceptible channel, but simply filtered promiscuously underneath the blocks. While scrambling over them I was amazed at the vast extent of ruin, and began to speculate, whether they had been carried there by ice, or whether they were due to the

disruption of ancient mountain-ranges similar in structure to the Viso. Certain peculiarities in the grouping of the fragments led me to suspect their glacial origin, and we soon came upon evidences which placed it beyond a doubt. They were terminated to the eastward by a low range of cliffs, down which we had to descend, and where we found plenty of smoothed surfaces indicative of ancient ice. At the base of the cliffs the water is first collected into a stream, and here there are some châteaux and a verdant Alp. A little farther on, the infant river plunges through a narrow gorge, cut through rocks of serpentine, and cascades on to the lower level just beyond. The walls of the gorge are smoothed and polished, and chiselled into grooves, both deep and shallow, in exquisitely sharp preservation.

On the following day I observed extensive surfaces of *roches moutonnées* some miles below Paesana, so that it is certain that an immense glacier once filled the valley. If, as is highly probable, the remains of ancient moraines surround the sources of the Po as thickly as those of the Lenta, the eastern side of the Viso will present one of the most wonderful monuments of glacial action to be met with in the Alps.

We had to mount a rocky shoulder on the side of the gorge and then descend again, and on gaining the lower level we walked through pleasant fertile pastures until we arrived at the first group of houses in Oncino, which we reached at 6.10. The place being very uninviting, we resolved to make a push for Paesana. The main village of Oncino looked better than its outposts: it is situated in a most picturesque position on the left bank of the Lenta, in the midst of steeply-sloping walnut-shaded meadows, with the river in a gorge below. We hurried quickly through it, and descended the zigzags by which the path winds down

the tongue of rock which divides the Lenta from the Po ; just as it was getting dark we reached the junction, and struck into the comparatively good road leading to Pae-sana. We entered this village at 8.10, slept at the Albergò della Rosa Rossa, and by mid-day on the morrow we were back in Turin.

A brief account of the labours of other travellers in the neighbourhood of the Viso will put the reader in possession of some additional points of interest. Among the scanty information afforded by Murray upon the geography of the Cottian Alps, will be found a notice of a tour of the Viso made by Professor Forbes, who, in this as in so many other districts, was one of the first of English explorers, and whose name will ever be held in veneration by the many mountaineers who, like myself, owe their first love of the high Alps to the perusal of the fascinating pages of the "Travels in the Alps of Savoy." The paragraph in Murray has appeared, word for word, in several successive editions, and will be found at page 460 of the greatly improved issue for 1861. Being quite unable to understand it, I wrote to Mr. Forbes, asking for a reference to the original memoir. He informed me in reply that the passage in Murray was the only account that had been published, and that he furnished the particulars to Mr. Brockedon for insertion in the guide. Mr. Forbes has kindly placed at my service a copy of the journal of his expedition, and thus enabled me to give an accurate description of it. It turns out that Mr. Brockedon has been "improving his text," having antedated the expedition by ten years, and, by substituting the words Col de Coulaon for Col de Vallante, has made complete nonsense of the whole account.

Professor Forbes performed his journey in the summer of 1839, having with him a barometer which he had com-

pared with one in the possession of M. Guérin of Avignon. He reached Abries on June 30th, and engaged a *chasseur douanier* of the name of Rey as guide to the "Col de Viso." After a walk of two hours and a half he arrived on the evening of the same day at the chalet of "La Trouchet," where he slept. (This must be near the chalet of La Ruine, if not the same place.) On July 1st he started at 3.30 A.M., gained the col at 5.15, and descended to the lakes at the head of the Po, which he reached at 9.15. On the Piedmontese side they searched for the tunnel, but could not find it, as the opening was covered with snow. Mr. Forbes now proposed to his guide to attempt the circuit of the mountain. They had to cross "a spur of the Viso, which descends towards the plain, and which presented an edge much like a cockscomb," but luckily they found "a gap which let them pass," when they "suddenly fell upon a valley perhaps 2500 feet deep," "which has Ponte at its mouth," and into which they "had no alternative but to descend." Mr. Forbes then mounted to the Col de Vallante, "which adjoins the Viso on one side as La Traversette does on the other," passing some chalets on his way, and, descending into the valley of the Guil, reached La Trouchet at 5, and proceeded to La Monta to sleep, arriving there at 7.15. The following day he crossed the Col de la Croix into the Val Pellice. The results of the barometer observations will be found in the hypsometrical note. "I have used," writes Professor Forbes, "the term Col de Viso as synonymous with La Traversette: the latter, I suspect, is more correct."

The next tour of the Viso of which I have any knowledge, was made by my friend Mr. A. P. Whately, accompanied by Mr. H. T. Jenkinson. On September 12th, 1854, these gentlemen walked from Abries to the now ruined bergerie near the head of the Guil, where they passed

the night. On the morning of the 13th a climb of fifty-five minutes brought them to the Col de Traversette, and proceeding by the sources of the Po, they descended to the chalets of Ponte, where they slept, after a day's walk of eight hours and a half, exclusive of stoppages. On the 14th they crossed the Col de Vallante to the bergerie in three hours and a half, and went to Bobbio the same day by way of the Col de Seylières. It is not quite clear how Professor Forbes and Mr. Whately passed from the valley of the Lenta into the Val Chianale, but I think it must have been by the Col de Costa Rossa.

The last explorer whose investigations I have to record is Mr. Whymp, who visited the Viso in 1860, approaching it from Turin by way of Paesana and Crissolo. He left the latter place at 7.40 A.M. on September 11th, and mounted to the "Col de Viso" alone in a thick fog, reaching the summit at 3.10 P.M., but having waited an hour on the way to avoid rain. He stayed forty minutes on the col and descended into the valley of the Guil, and after another halt of an hour arrived at Abries at 8.30. In 1861 he went again to Abries, and on August 10th slept in the highest chalet, ascending with the shepherd the following morning to the col he had crossed the year before, with the intention of examining the peak. The part of the chain which Mr. Whymp reached is that marked Col de Coulaon in Bourcet, and Col del Color de Porco in the large Sardinian Map, and he insists that, according to the inhabitants, this is the true Col Viso, and that the Traversette is a lower pass much farther from the peak. There can be no doubt as to the place reached by Mr. Whymp, as he saw close at hand the great ravine which arrested our progress in 1860; and having climbed the intervening crag with the intention of descending into it, was stopped by precipices, just as Hawkshaw and

Michel Croz had been at the very same spot. Being prevented by the ravine from getting on to the peak, he returned the same day to Abries. The confusion about the Col de Viso wants clearing up, and renders it desirable that the name should be expunged from our Alpine vocabulary.

I trust that the preceding narrative may have the effect of directing attention to the charming scenery of the Cottian and Maritime Alps, hitherto so much neglected by English tourists. Few parts of the great chain are accessible with so little expenditure of time and trouble. Turin is a most agreeable and luxurious resting-place, and a two hours' ride by railway from that city lands the traveller at Susa, Pignerol, Saluzzo, or Cuneo, at the very foot of the Alps. To any mountaineer bent upon climbing the Viso I will venture to give a few words of advice. Select, if possible, a time for the expedition when the weather gives a fair chance of a wide Italian view; pass the first night at Saluzzo; lay in there a good supply of provisions, and arrange for a very early start to Sampeyre to avoid the heat. By leaving Saluzzo at 4.30 A.M. Sampeyre might be reached at 9. Stay there an hour for breakfast. Put the baggage on a mule, and after passing Château Dauphin, follow the Vallon de Forciolline, and bivouac in the gorge near the foot of the Sagnette, taking the mule as far as practicable. A sheltered camping-place might be found very high up, and by carrying wrappers and a little hay from Château Dauphin, and fire-wood from the Arolla forest, it would be possible to pass a really comfortable night.

Considering the wonderful advantages possessed by the Viso as a station for trigonometrical and meteorological purposes, the apathy of the Sardinian geographers towards their noble mountain is truly extraordinary, and can only be accounted for by a radical peculiarity in the tempera-

ment of the Italian people. The chasseurs of St. Gervais have built a cabin on the Aiguille de Gouté, a peak of about the same height, much farther N., and scarcely less difficult of access. I trust the time is not far distant when there will be a similar erection on the Viso, where persons interested in "*la Physique du Monde*" may reside in settled weather several days together, and where there will be placed a series of meteorological instruments which will be examined by competent observers at least once a year.

HYPSONOMETRICAL NOTE.

I have collected into this note all the information I am acquainted with relating to the altitude of the Viso and other neighbouring points of interest described in the foregoing paper. I commence with an account of my observations upon the peak itself, and of the method employed in conducting the calculations.

Date, August 30th, 1861. Time 10.20 A.M.

Bar. red. 486.14 mil., 19.149 inches.

Air Temp. 6.6 Cent. Moist bulb 2.0 Cent.

Relative Humidity .35. Sky clear.

	Compared with Turin	Compared with Geneva and St. Bernard
Index error of metrical scale } of my barometer	. + 1.46 mil.	+ .49 mil.
Index error of English scale	. + .06 in.	+ .027 in.

Corresponding Observations.

Turin Academy. Altitude of barometer cistern, 284 metres.

Time	Barometer reduced	Air temperature
9 A.M.	743.48 mil.	23.0 Cent.
Noon	741.88	29.3
Resulting altitude from metrical obser- } vation by tables of Delcros	. 12,675 Eng. feet	
Resulting altitude from English obser- } vation by tables of Guyot	. 12,659	
Mean	12,667	

Geneva. Altitude of barometer cistern, 408 metres.

Time	Barometer reduced	Air temperature	Moist bulb	Rel. humid.
10 A.M.	733.19 mil.	23.60 Cent.	15.80 Cent.	.41
Noon	732.60	27.60	16.35	.28

Resulting altitude from metrical obser- vation by tables of Delcros	}	. 12,737 Eng. feet
Resulting altitude from English obser- vation by tables of Guyot		
Mean . . . . .		. 12,716
		. 12,726

St. Bernard. Altitude of barometer cistern, 2478·3 metres.

Time	Barometer reduced	Air temperature
10 A.M.	574·31 mil.	10·3 Cent.
Noon	574·34	12·8

Resulting altitude from metrical obser- vation by tables of Delcros	}	. 12,623 Eng. feet
Resulting altitude from English obser- vation by tables of Guyot		
Mean . . . . .		. 12,601
		. 12,612

For the purpose of better comparison, the Geneva calculations have been made by the same tables as the others, and not by those of Plantamour, based on Bessel's formula, which contains a term involving the difference of the relative humidities at the upper and lower stations.

Hence, recapitulating, we have —

Turin . . . . .	. 12,667 Eng. feet
Geneva . . . . .	. 12,726
St. Bernard . . . . .	. 12,612
Mean . . . . .	. 12,668

These results are somewhat greater than the previous trigonometrical determinations, of which two appear to have been published. The first is 3836 metres, or 12,585·5 English feet, and is contained in the memoir of M. Corabœuf, entitled "Notice sur une mesure géométrique de la hauteur au dessus de la mer de quelques sommets des Alpes, par M. Corabœuf, Chef d'Escadron au Corps Royal des Ingénieurs Géographes." ("Recueil de Voyages et de Mémoires publiés par la Société de Géographie, tome ii., Paris, 1825.")

This is apparently the same as the height given in Von Welden, where we find, p. 30 —

	Fr. ft.	Eng. ft.
"Monte Viso nach Herrn Plana"	. 11,808	= 12584·5

as a difference of a unit may easily be made in transferring an altitude from one measure to another. The discrepancy as to the authority may be accounted for in the following manner. M. Corabœuf states in his memoir, that he "co-operated" in the work,

and probably Mr. Plana was one of his coadjuteurs. The second determination is by the État-Major Piémontais (see the Quadro di Altezze in "Le Alpi che cingono l' Italia," p. 782). It is 3840 metres, or 12,599 English feet.

In the list of heights given in Appendix A to Sir John Herschel's "Physical Geography," the altitude of Monte Viso is stated at 13,599 feet. I presume this is from the last-quoted authority, and that a mistake of 1000 has been made in converting metres into feet. On a reference to M. Corabœuf's paper, it will be found that the 3836 metres is the mean of 5 independent determinations, of which the following is a list:—

	Metres	Eng. ft.
Superga	3835.37	12,583.4
Massé	3830.51	12,567.5
Rivoli	3840.30	12,599.7
Madona di Crea	3846.54	12,620.1
Mont Penice	3829.00	12,561.8
Mean	3836.34	12,586.5

The highest of these, 12,620 feet, is greater than the lowest barometrical result of 12,612 feet, so that the discrepancy is less than might be at first supposed.

I now proceed to the barometer observations made by Professor Forbes in his journey of June 30th and July 1st, 1839. The barometer was, at starting, compared at Avignon with an instrument belonging to M. Guérin of that town, with which it agreed within the twentieth of a millimètre. The calculations were made by M. Guérin, and Professor Forbes has obligingly favoured me, not only with his original observations, but with M. Guérin's results:—

			Bar.	At Ther. Cent.	Air temp. Fahr.	Resulting height Eng. ft.
La Troughet*,	June 30th	7.40 P.M.	598.4 mil.	*	*	6663
Col de la Tra- versette,	July 1st	5.45 A.M.	531.8	-0.8	25	9992
Lakes of the Po,	July 1st	9.15	558.7	15.3	39	8582
Col Vallante,	July 1st	3.45	542.7	7.2	37	9330

Mr. Forbes has also furnished me with two other determinations of the Traversette. The first of these is very ancient. In the "Philosophical Transactions for 1777," vol. lxvii. Part 2, page 513, is an elaborate paper by Sir George Schuckburgh, Bart. F.R.S.,

* The thermometers were not observed at La Troughet, and probable values were doubtless assumed by M. Guérin.

entitled "Observations made in Savoy in order to ascertain the Height of Mountains by means of the Barometer; being an Examination of M. de Luc's Rules, delivered in his *Recherches sur les Modifications de l'Atmosphère*." Appended to this memoir is a table of heights, in which will be found, p. 595 —

"Monte Viso, by an observation from Jurin, by means of accurate, G." (i. e. by comparison with Geneva)	Eng. ft. 9,997
--	-------------------

Monte Viso must here mean a col and not a peak, and is no doubt the same as that crossed by Forbes. The other is by M. Guérin from an observation made in 1819, and in English measures is equivalent to 9,963 feet. The height given by Von Welden for this col, p. 94, is evidently from the same observation: —

"Col de Traversette am Viso"	Eng. ft. 9,963
------------------------------	-------------------

The three results agree very fairly. But then if we refer to the "Quadro di Altezze" in "Le Alpi che cingono l'Italia" we find, p. 782, on the authority of the "État Major Piémontais," "Colle delle Traversette 2,995 mètres," or 9,826 English feet, a determination so much below the others, that it suggests the possibility of its applying to some other part of the ridge.

The heights referred to in this note and in the preceding paper are collected in the following

Table of Heights.

Name of Station.	Authority.	Date.	Method.	Height in English ft.
Monte Viso. Summit . . .	Corabœuf . . .		Δ	12,586
"	État Major Piémontais (Le Alpi, &c.)		Δ	12,599
"	Mathews . . .	1861	Bar.	12,668
"	Mathews . . .	1861	Bar.	11,249
Col de Traversette . . .	Schuckburgh . . .	1777	Bar.	9,997
"	Guérin . . .	1819	Bar.	9,963
"	Forbes . . .	1839	Bar.	9,992
"	E. M. P. (Le Alpi, &c.)		Bar.	9,826
Col de Vallante . . .	Forbes . . .	1839	Bar.	9,330
"	Mathews . . .	1860	Bar.	9,366
Col de Seylières . . .	Mathews . . .	1860	Bar.	9,247
Lakes of the Po . . .	Forbes . . .	1839	Bar.	8,582
La Troughet (= La Ruine ?)	Forbes . . .	1839	Bar.	6,663
Châlets in Val Vallante (Pian Meyer ?)	Mathews . . .	1861	Bar.	6,535
Abries	Mathews . . .	1860	Bar.	5,000

CHAPTER X.

EXCURSIONS IN DAUPHINÉ.



1. INTRODUCTORY REMARKS.
2. THE PASSAGE OF THE COL DE LA TEMPE, FROM
THE VALLEY OF LA BÉRARDE TO THE VAL LOUISE;
AND OF THE COL DE L'ECHAUDA, FROM VAL
LOUISE TO LE MONÉTIER.
3. THE VAL DE ST. CHRISTOPHE AND THE COL DE SAIS.
4. A SKETCH OF THE COL DE LA SELLE, FROM LA
GRAVE TO ST. CHRISTOPHE.
5. THE ASCENT OF MONT PELVOUX.

1. INTRODUCTORY REMARKS.

THE province of Dauphiné embraces three "Departments," "Drôme," "Isère," and "Les Hautes Alpes." Its principal town, Grenoble, lying due west from Turin, is placed upon the river Isère, a tributary of the Rhone.

Nearly in the centre of the province, and on the boundary between the departments of Isère and Les Hautes Alpes, is a remarkable granitic mountain group, situated on a spur of the main chain of the Alps, between the rivers Isère and Durance. This district has been hitherto but imperfectly explored by mountaineers. A description of some portions of it will be found in Professor Forbes's "Excursions in Dauphiné," appended to his volume on "Norway and its Glaciers," and a general account in Elie de Beaumont's "Faits pour servir à l'Histoire des Montagnes d'Oisans."

The following papers are a further contribution to the information we possess respecting it, and will, it is hoped, have the effect of drawing the attention of travellers to its various attractions.

Mr. Nichols, in the first excursion described, starts from Bourg d'Oisans, and ascends the Valley of St. Christophe. A short distance above the village of that name, the valley

forms two branches — the western one leading to the Col de la Muande, and the eastern one to La Bérarde. Mr. Nichols follows the eastern branch, and, passing La Bérarde, crosses the Col de la Tempe on the north side of Mont Pelvoux, and descends to Serré, in the Val Louise. He then turns again northwards and crosses the Col de l'Echauda, descending upon the village of Le Monétier, on the high road from Grenoble by the Col de Lautaret to Briançon.

Mr. Bonney takes the same spot, Bourg d'Oysans, for his starting-point as Mr. Nichols. He ascends the same valley, visiting St. Christophe, and examining the neighbourhood. Passing La Bérarde, he next ascends the Col de Sais, leading to the Val Godemar. He then returns to La Bérarde and Bourg d'Oysans, and thence proceeds to Briançon and the entrance of the Val Louise. An attack upon Mont Pelvoux was made from this side, which, however, the return of bad weather rendered unsuccessful.

In the following year a successful ascent of the Pelvoux was made by Mr. Whymper, whose account of the expedition follows those of Mr. Nichols and Mr. Bonney. It does not, however, appear that this mountain forms the culminating point of the Dauphiné group. The Aléfroide, which rises at a distance of about two miles, and in a westerly direction from the pyramid peak of Mont Pelvoux, is the summit which domineers over all competitors. This crowning height is yet unscaled, and its precipitous ramparts still bid defiance to the mountaineer.

2. THE PASSAGE OF THE COL DE LA TEMPE, FROM THE VALLEY OF LA BÉRARDE TO THE VAL LOUISE; AND OF THE COL DE L'ECHAUDA, FROM VAL LOUISE TO LE MONÉTIER.

By R. C. NICHOLS, F.S.A.

WHILE the mountains and glacier passes of Switzerland are known to and visited by thousands, comparatively few of our countrymen are acquainted with the lofty mountain group which forms the high-lands of Dauphiné. In altitude and picturesque magnificence, the latter are little inferior to the Swiss Alps. Still it will not be difficult to find reasons why they are comparatively neglected. The scenery within reach of those whose strength or enthusiasm are not equal to the more difficult excursions, will not compare with that which Switzerland affords even to the most *fainéant* tourist, and the forbidding character of many of the passes renders communication between valleys situated within a few miles of each other extremely rare, and each valley becomes to the ordinary tourist a *cul de sac*, after exploring which, with unsatisfactory result, he must retrace his steps, and find a circuitous route to his next destination. It need hardly be said that visitors are unfrequent, and hence there is an almost total absence of accommodation for the traveller at the remoter villages. As the higher passes are not situated on a frontier, there is a lack of the stimulus which in many mountain regions trains up good guides and hardy mountaineers — the pleasure and profit of smuggling, while the few who possess a

knowledge of the higher regions place an exorbitant value on their assistance.

Nevertheless, to those who like hard work, who don't mind roughing it, and to whom difficulties are rather attractive than repellent, an exploration of the passes and glaciers of Dauphiné will prove as satisfactory as any excursion they can make in the Alps. I would venture, however, to offer two recommendations to such as may be disposed to make the trial—first, not to go alone, unless they possess a special delight in Alpine solitudes, and a perfect independence of social intercourse; secondly, not to make too numerous a party. This is always unadvisable in the Alps, and more so in Dauphiné than elsewhere, on account of the deficiency of accommodation. I committed the former error, not indeed wilfully, but because a promised companion was unable to leave England. Not being aware how rare a bird a traveller is in those parts, I had hoped to have fallen in on my way with some one like-minded with myself. Fortune in this respect did not favour me. From Grenoble to Turin I did not meet with a single Englishman, nor, indeed, with a traveller of any other country, except such as, with commercial objects in view, were pursuing their journey upon the high roads.

On the 7th of August, 1858, I arrived at Bourg d'Oysans, having travelled direct from Paris to Grenoble by railway, taken the diligence to Vizille, about ten miles farther, and walked through the fine Combe de Gavet. My plan was to ascend the Valley of La Bérarde, and, if practicable, to cross the mountains either on the north or south of Mont Pelvoux to Val Louise.

Notwithstanding the assurances of M. Martin, the landlord at the Hotel de Milan at Bourg d'Oysans, that this would be impossible, I had not much fear of being compelled

to retrace my steps ; for I knew how strangely the difficulties of the mountains' are sometimes exaggerated by dwellers in the neighbouring valleys. My host stated, and for all I knew correctly, that this summer there was an unusual quantity of snow ; but supposing this to be true—and it proved to be the reverse of the truth—I failed to see in it any reason for changing my plans.

I could not hear of any guide at Bourg d'Oysans who knew anything of the mountains ; but I heard that Professor Forbes' guide, Joseph Rodier, was still living at La Bérarde, so I was satisfied to take with me to that place a man named Etienne Eméti, who was recommended to me by my landlord, M. Martin, and whom I afterwards learned to be M. Martin's father-in-law. This constituted, in fact, his principal qualification for the service, as he had never been higher up the valley than St. Christophe, and was by no means a stout walker. He was fortunately equal to the only duty I required of him—namely, that of carrying a light knapsack. The way was plain enough, and, had I not been desirous to husband my strength with a view to the possible requirements of the morrow, I could very well have dispensed with his services.

The next morning, August 8th, I set out from Bourg d'Oysans at 6.30. The path leaves the high road at Bourg, and is carried for some distance along the bed of the wide torrent which is formed by the Vénéon. After about an hour and a half, the lofty walls of limestone which shut in the broad valley become more contracted, and the ascent towards Vénos commences. Soon the snow-topped mountains near St. Christophe come into view, and after about an hour's ascent the village of Vénos is reached. Here I learned that my guide, whom I had agreed to provision by the way, had prudently abstained from breakfasting at his own expense before setting out ; so we halted

for a short time *chez* Vial, while he refreshed himself with bread and cheese.

The village of Vénos is at some height above the stream on the N. side. On leaving it for St. Christophe, the road descends to the Vénéon, and, crossing a new stone bridge, commences immediately a rapid ascent up the Valley of St. Christophe, over and among a number of huge boulders. After about an hour from Vénos, the stream is again crossed by a natural bridge, formed by immense fallen masses of granite, and a more level but still desolate part of the valley is reached. This is traversed in about half an hour, and then commences another ascent, which continues rapidly up to St. Christophe. We reached this place about 11.45, and, on entering the inn, were shown into a very dirty smoky room, serving for parlour, kitchen, bed-room, and all, which looked by no means promising. My guide, however, having intimated that this was by no means the thing for a person of my quality, a loft in a neighbouring building was swept out and garnished for my reception. This loft contained a bed, two chairs, and a two-legged table hinged to the wall; and here, after some delay, they brought us good bread, cheese, honey, hot milk, and wine. Meat was also offered, but we did not try it. On inquiring for Rodier, we were told that he had not been down from La Bérarde that day. It was Sunday, and most of the inhabitants of the upper valleys had come down to St. Christophe to hear mass.

We resumed our journey at 2 o'clock, and about 3 reached the entrance of the Combe de La Bérarde. The valley at this point forms two branches, the principal one being that to the east, along which my course lay. After passing through a narrow and rocky defile for about another hour, we came again upon a wider, and partly cultivated tract, and passed the little village of Les Etages

where there is a small chapel. At this point the mountains above La Bérarde came in view; including the Montagne d'Oursine, the Pointe des Verges, and on its right a peak which, according to Bourcet's map, would be the Pelvoux, though that summit is really not seen at all from this valley. I arrived at La Bérarde at 5.5 P.M. The village, consisting of a few cottages only, stands at the confluence of two glacier streams, that on the left descending from the Mont d'Oursine, and that on the right from the Pelvoux. The scenery is grand but desolate, the valleys shut in by lofty and precipitous cliffs of granite. I found that the inn at La Bérarde was kept by the very Joseph Rodier of whom I was in search. It affords no beds, but the kitchen is clean, and the food good, though coarse. The Joseph Rodier who conducted Forbes over the Col de Sais in 1834, was now too old for such excursions, but his son of the same name, a strong good-looking young fellow, was ready to undertake to guide me over any of the practicable passes. By his recommendation I decided on attempting the Col de la Tempe on the N. side of Mont Pelvoux, leading directly to Val Louise. Rodier informed me that he had himself discovered this passage, and had been the first to cross it seven years before, but had not crossed it since. At the time of Professor Forbes' visit, it had been considered impracticable. It had since been crossed by one or two persons. Rodier had conducted an Englishman to the summit in 1857, but they had returned to La Bérarde. No one had yet passed that year, and he would not guarantee that we should succeed. The difficulties, however, appearing by his account to be not excessive, I retired to rest on a couch of hay in the barn, with agreeable anticipations for the morrow.

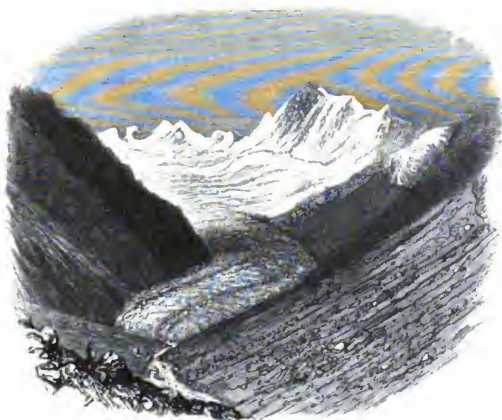
August 9th.—I had been rash enough to accept the loan of a coverlet from Rodier's house, and so incurred evils

from which my hay-bed might otherwise have been exempt, and lost a portion of the sound sleep which would have been the best preparation for the day's work. We were stirring soon after 3 o'clock, and I made my toilet by a bath in the glacier stream which flows past the house. I had not yet inquired how much Rodier would expect for his services, and now found that his terms were twenty francs per day, irrespective of the nature of the excursion, and the same for returning, in addition to provisions. He was very decided not to take less, and there was no choice but to comply. I decided, however, not to retain him beyond the day's expedition, though I found him so good a guide that I should otherwise have availed myself of his services longer; and for the two days' work he did in crossing with me to Val Louise, and returning alone, the forty francs he received were fairly earned.

We were to have started at 4; but, as is usual in such cases, our preparations detained us much longer than we had anticipated, and we were not fairly on our way till 6.5. We ascended the valley of La Bérarde, keeping near the stream, until after passing the tributary valley of Clot Châtel on the right, in which a dirty glacier called "Le Chardon" descends nearly to the main valley.

We then ascended over the *detritus* brought down by the torrent marked on the map as the Vallon de la Pirade, and, immediately beyond this, began to mount the steep side of the valley on the left, toilsomely scrambling over loose stones that soon became intermixed with grass. Near the foot of the slope I halted ten minutes to make a sketch of the Glacier de Condamine, which closes the extremity of the Valley of La Bérarde: from this the annexed illustration is taken. My guide informed me that a passage over this was formerly practicable to Val Louise by the Glacier of La Sapenière, but that it was now impassable. To the

right of this glacier is the Col de Sais, leading to the Val Godemar, of which Forbes has given an account in his "Excursions in Dauphiné." At 8.25 A.M. we reached the foot of the first rocks, where, after ten minutes' rest, we had to climb along a steep face of rock. At 9.5 we halted in a cave, the sun's rays being already powerful, and took some refreshment. Here we seemed to be close to the foot of the glacier, but had to climb for forty minutes



COL DE SAIS, AND GLACIER DE CONDAMINE.

more up the moraine before setting foot on the first snow. At 10.15 we were on the glacier itself. The snow which covered it, though for the most part in good condition, was generally steep, and, no snow having fallen for a considerable time, afforded but little foot-hold. We had no spiked alpenstocks, which are not to be found in Dauphiné, and with which the traveller should provide himself before going thither, but only sticks without

spikes, which afford poor support on hard snow-slopes. Rodier lent me a pair of crampons, but I found them very inconvenient. From the absence of recent snow, the crevasses were also more difficult to pass. We had no ladder, and at one moment Rodier was doubtful if we should succeed; but by patience, and making some rather long circuits, we got safely past them all, though on one occasion by a snow-bridge which did not appear very secure. This was the last crevasse, and was formidable more from the greater height of its farther side than from its width. Shortly after passing this, we reached the summit of the Col de la Tempe at 12.10. It consists of an arête of jagged and crumbling slaty rocks, extending from the Pointe des Verges, which overhangs La Bérarde, to another peak, seen also from La Bérarde, which rises directly above the glacier of La Côte Rouge, and is not distinguished by Bourcet from the Pelvoux. Before reaching this summit, however, there are two little peaks on the arête, to the nearest of which I scrambled along the ridge, and then a square gap about five hundred feet lower than the point where we crossed; it is capped with snow on the west, but, from the precipitous descent on the other side, must be totally impassable. This gap was noticed by Professor Forbes from the top of the Col de Sais, and he observes that through it "it is possible that a passage into the Val Louise might be attempted,"—a natural supposition, from the appearance of the west side alone. The peak beyond this was called by Rodier L'Aléfroide*, though perhaps improperly, as it is more remote from the chalets of that name than the Pelvoux

* This peak is called by the French engineers the Pointe des Arcines, or des Ecrins (see the passage quoted on the next page), but I have retained the name of Aléfroide, as Mr. Whympster calls the summit of the Pelvoux, which he ascended, the Pointe des Arcines.

proper, which lies farther to the east. There is not much difference between the heights of the two points. It would seem, indeed, from a passage of Elie de Beaumont*, that the nearer peak is in reality the culminating summit of the group, and this is confirmed by Mr. Whymper's observations. The mountain referred to, at a distance of about two miles from the pyramid peak of the Pelvoux, could be no other than the Aléfroide, though its direction is nearer due west than north-west from the Pelvoux. This crowning summit of the Dauphiné Alps yet remains to be ascended, and no small credit will be due to the mountaineer who shall surmount its precipitous flanks. The height of the col at the point where I crossed must be about 10,000 feet. It does not command any distant view, being shut in on all sides by lofty mountains; but I could see the summits of some of the more distant peaks of the Piedmontese Alps in the direction of the Mont Cénis. The nearer prospect was, however, of a very grand character. The fantastic forms of the d'Oursine, the Montagne des Agniaux, and the Pelvoux, rose from the wide basin of ice and snows before me into a cloudless sky of deepest blue, inclosing a world of their own, which impressed the imagination the more powerfully from its entire severance from known or inhabited regions.

I remained on the col for nearly an hour, enjoying the romantic scene before me, and not the less so for the

* Elie de Beaumont.—Faits pour servir à l'histoire des Montagnes de l'Oisans:—"De cette première cime (the peak ascended by the French engineers) ils en ont reconnu une autre plus élevée située à environ 3,000^m au nord-ouest, c'est à dire dans la direction de La Bérarde. Cette dernière, qui s'élève, d'après leurs mesures, à 4,105^m au dessus de la mer, est sans doute la même que MM. Carlini et Plana avaient mesurée, et à laquelle ils avaient trouvée 4,100^m de hauteur. Cette cime, qui s'appelle la Pointe des Arcines, ou des Écrins, peut en effet être considérée comme faisant partie du massif du Grand Pelvoux et comme en formant le point culminant." The height of the pyramid peak, which they ascended, is given by the French engineers as 3,933 mètres.

excellent appetite which the mountain air had given me for the mid-day meal. The sun had made the bare dark rocks so warm, that my thermometer stood at 48° in the shade. On commencing our descent, we came immediately to a steep and difficult passage over the rocks to the right, and down a precipitous couloir blocked up with huge loose stones, which required great caution in stepping on them, as a mere touch would often set them in motion. This occupied nearly an hour, and we reached the top of the glacier about 2 o'clock, just under the gap in the ridge which I have before mentioned.

This glacier was called by Rodier the Glacier Noir, and, commencing under the arête I had crossed, it passes eastwards along the north of the Pelvoux, receiving the snows which descend from its precipitous sides, and then, turning to the south, it terminates in a vast moraine.

After descending the glacier for some distance, keeping always near its left side, opposite to the Pelvoux, we reached a point where, the fall becoming rapid and the crevasses numerous and wide, we were compelled again to take to the rocks on the left. While still on the ice, I made a hasty but careful sketch of the outline of Mont Pelvoux as seen from this point. It presents a wonderfully jagged wall or precipice of rock, partly intersected by couloirs of snow, rising above the glacier to a height of 4,000 or 5,000 feet. From this sketch the annexed woodcut is engraved.

Passing a shoulder of rock, we descended a very steep slope of broken stones. We might have selected a slope of snow by one side, which looked very inviting to a glissade, but it was so hard and steep that it would have been dangerous to try it, terminating, as it did, by the usual bergschrund at its junction with the glacier. The

foot of the slope we were descending brought us to a lower and more level part of the glacier, at the junction of another branch from the north, which we crossed. This part was not at all crevassed, but intersected with numerous channels, in which ran clear streams of water, arising from the melting of the surface.

After crossing this branch, we betook ourselves to the lateral moraine on the left, and continued a steep and



PINNACLES OF MONT PELVOUX, FROM THE GLACIER NOIR.

inconvenient descent until we had nearly reached the foot of the glacier. Its lower portion, as before mentioned, is almost entirely covered with moraine, principally of dark-coloured greenstone and syenite. But it is met at its foot by a smaller glacier, descending steeply from the east, and of a strikingly different aspect, being as pure and clear, to its very base, as the Rosenlaui or the Bossons, and exhibiting the same beautiful blue tint in its crevasses. This is appropriately called the Glacier Blanc.

We descended over the foot and terminal moraine of the Glacier Noir, and found ourselves between the two streams

which issue from the glaciers. As these joined some distance lower, it was necessary to cross one of them, and Rodier decided on still keeping to the left, as on the other side there would be some danger from falling stones.



GLACIERS OF THE VALLEY OF ALÉFROIDE.

It was 5.20 P.M. when we left the glacier, and the weather, which up to this time had been most brilliant, began to change. A cloud had gathered about the Montagne des Agniaux, which in a few minutes overspread the sky, when rain began, and continued for the rest of the evening.

The passage of the glacier stream, or rather streams—for it was too deep and violent to be waded at the places where it ran in a single channel, and it was consequently necessary to take them in succession — was not agreeable.

The water was ice-cold, and in more than one channel above our knees, and strong enough to make it difficult to keep our feet. This was, however, our last difficulty, as we had now done with the glaciers, and had only to make the best of our way to habitable and inhabited regions. We had still some distance before us, and, though we lost no time, it was already 8.50 P.M., and had been dark for some time, before we reached the first house where a bed could be procured. This was at Serré, about two hours above the *chef lieu* of Val Louise, *chez Moiran*. The accommodation was of the humblest description; but we were by no means disposed to be particular about trifles, and were very glad of some of the Femme Moiran's *soupe de ménage*.

I learned upon inquiry from Moiran some particulars about Mont Pelvoux. Rodier was not aware that it had been ascended, and did not think it possible. Moiran stated, however, that two successful ascents had been made on this side from the Valley of Sapièrre, each time by a party of Frenchmen, the first being from Grenoble and the second from Lyons. They passed two nights in a *châlet* formerly occupied by the *Bergers* of Provence, to whom the commune had for some time been accustomed to let the pasturages of the Valley of Sapièrre. The ascent had occupied about seventeen hours in all. The adventurers had taken the field in great force, with numbers of guides, porters, &c. The Provençal herdsmen no longer come to the valley, but the *châlet* was believed to be still in existence.

The next day I passed the Col de l'Echauda to Monétier. This pass presents no difficulty, and, though elevated, did not in 1858 show much snow. It affords, however, some grand effects of rocky scenery, and commands fine views of the Pelvoux. These latter I was compelled to imagine, as the mountain was shrouded the

whole day in cloud and rain, which must have fallen heavily on my line of route of the previous day. I was fortunate enough to escape without much inconvenience from the weather, though occasional showers, and the constantly threatening appearance of the clouds, compelled me to hasten.

Joseph Rodier had left early in the morning on his return to La Bérarde, and I arranged with my host Moiran to conduct me to Monétier. My guide was an elderly man and not very strong, and he prudently availed himself of his daughter's assistance to carry my knapsack—a very light one—part of the way, and afterwards committed it to the charge of a muleteer who was returning to Echauda after conveying a load of grass to Val Louise. We met several strings of mules so loaded in our ascent.

We started from Moiran's house at Serré at 7.55 A.M., crossing the steep sloping fields at the back till we reached the path from Val Louise to the Valley of Echauda. An easy ascent of two hours and a half brought us to the village of Echauda, a straggling collection of chalets, at one of the last of which we halted and had some milk. At 9.50 we continued our ascent over green slopes on the right of the valley, and, keeping to the right of the rocky precipices, which seem from below entirely to close up its extremity, arrived at their summit at 11.5. After traversing a basin-shaped green valley with lofty rocky peaks on each side, we passed the actual col at 11.20. Our descent upon Monétier, including a halt at the first spring we met with, to eat the bread and hard-boiled eggs we had brought with us, occupied rather less than two hours, as we were somewhat hurried by the rain, and we found ourselves at the little town of Monétier, *chez* Armand, at 1.15 P.M. In the afternoon I went on to Briançon by the diligence.

The continued unfavourable weather decided me on leaving any further explorations of the mountains of Dauphiné for a future opportunity, should any such occur, or, if not, for other adventurers. There is much ground yet unexplored, many summits unascended, and an extensive region undescribed; and it must be admitted by Alpine travellers that a district, second only to Switzerland in the altitude of its summits and the grandeur of its scenery, is deserving of a larger share of their attention than it has hitherto received.

P.S. — There is no good published map of this district. That of Bourcet (1784), which is praised for its accuracy by Professor Forbes, is tolerably correct for the main valleys, but in the higher regions, and even in the positions of the principal mountain tops, is not to be depended upon. No delineation of the form or limits of the glaciers is attempted, their existence being merely indicated by the word 'glacier' written here and there among the mountains. Later maps appear to have been, for the most part, copied from Bourcet without improvement. A new survey has lately been made by the French Government, but it is not yet published. Having been intrusted with the task of preparing the map which illustrates this paper and those of Messrs. Bonney and Whymper, I have taken that of Bourcet as a basis, and for the details have availed myself of all the information I could obtain from views and sketches, and from the recollections of myself and the writers of the following papers. If, with these imperfect materials, some errors should hereafter be discovered in the resulting sketch, I trust that future visitors to the locality will give their assistance to correct them in a later edition.

3. THE VAL DE ST. CHRISTOPHE AND THE COL DE SAIS.

BY THE REV. T. G. BONNEY, M.A., F.G.S.

THERE is, perhaps, hardly any district in the Alps more rarely visited, and about which it is more difficult to procure accurate information, than the mass of mountains lying between the Romanche and the Durance, and forming the most important part of the Alps of Dauphiné. According to common report, the highest summit in the district is a peak of Mont Pelvoux, called by the French engineers who measured it the *Pointe des Arcines* or *des Ecrins*, and stated to be 13,468 feet above the level of the sea, and quite inaccessible.

The only Englishman who, to my knowledge, has published any account of this country* is Professor Forbes, who, in some most interesting chapters at the end of his work on "*Norway and its Glaciers*," describes the pass that forms the subject of this paper, with one or two others in the neighbourhood. So attractive was his account, that I felt a strong desire to explore this region more minutely — a desire in which my friends Mr. Wm. Mathews and Mr. J. C. Hawkshaw so fully sympathised, that early in the summer of 1860 we arranged to visit Dauphiné, and attempt the ascent of the Pelvoux.

* There is a very interesting memoir on this district by Mons. E. de Beaumont (*Annales des Mines*, 3me série, tom. v.); but it is of little topographical value, as the writer was evidently rather confused about the Pelvoux, and was chiefly attentive to the geology of the country.



LA BERRARDE.

The only map of the country worth anything is an old one by General Bourcet, according to which the Pelvoux is formed by the union of three ridges, two of which partially inclose the head of a branch of the Val de St. Christophe, and the third divides the upper part of the Val Louise. Professor Forbes' account appeared to confirm the map; so, as the highest peak was reputed inaccessible from the side of Val Louise, we thought it would be better to examine the other side first, in hopes that it might be possible to find a way up by it. If it proved too precipitous, we intended to cross the Col de la Tempe into the Val Louise, from which side one of the inferior peaks had been reached.* The impression we had obtained from the map was, in several respects, quite wrong; and my object in writing this paper is to give future travellers the advantage of our experience, so that they may know, rather better than we did, what has been done and what remains to be done.

Hawkshaw and I could not leave England till early in August, and Mathews wished to visit the Tarentaise on his way; so we made an arrangement to meet at La Bérarde on the 12th of August, and commence work from that place.

After a rapid journey from England, we arrived at Bourg d'Oysans in pouring rain after dark on the evening of the 10th. We found tolerable quarters at the Hotel de Milan, *chez* Martin, and went to bed with but faint hopes of fine weather on the morrow, but on waking in the morning were delighted to find the clouds rapidly rolling up the hills, with every promise of a lovely day. Accordingly, we started at about 7.45 A.M., and after the usual difficulty in extricating ourselves from the village, got upon the road to the Val de St. Christophe.

* By MM. Durand and Leclerc, French engineers. They give its height as 3933.97 mètres.—*Annales des Mines*, 3me série, tom. v. p. 18.

Bourg d'Oysans is built on a swampy flat, formed by the confluence of the Romanche and the Vénéon. Surrounding this, rise magnificent cliffs, some in massive walls of shale and limestone, others in sharp crags of metamorphic slate. In no other place have I seen the bands of dark purple shale and grey limestone so beautifully combined, or on so vast a scale. From Bourg d'Oysans the Val de St. Christophe appears to be the natural continuation of the valley, the gorge by which the Romanche enters being so narrow that it is not easily distinguished. Quitting the shade of the trees that surround the village, we crossed a wide stony flat, intersected by many small streams, and formed by the débris brought down by the floods, which in Dauphiné are unusually destructive. After stumbling for some time over this in the hot sun, we were not sorry to find a path on the slopes below the precipices, on the right hand side of the Vénéon. From this we looked back over the green valley which we had just left to the walls of rock that overhung it, and the fields and trees beneath did but give a wilder look to the precipices of the Belle Donne, which closed the view. The shelving banks of broken stone along which we were walking were covered with lavender bushes in full flower, over which numbers of beautiful butterflies* kept flitting in the sunshine. As we advanced, a fine snow-peak rose before us, and a smaller one† appeared up the Val de Louvitel on the right. This valley, in which is a little lake filled with excellent trout, is several hundred feet above the Vénéon, and appears to have the remains of an old moraine across its mouth. Not long after passing

* I find in my note-book the names of about twenty species, some of which are never, others rarely, found in England; *e.g.* *L. Sinapis*, *Lim. Camilla*, *V. Antiopa*, *P. Apollo*, several species of *Argynnis* and *Melitæa*, &c.

† Perhaps the Mont du Journalet (Bourcet).

this, while resting under a fine old walnut tree, we were surprised to see a large bed of snow, the remains of spring avalanches, in a narrow gorge on the right, not many hundred feet above us. No doubt this was due to the cold, late summer. About three hours' slow walking brought us to Venos, a village on the hill-side, some distance above the river. It stands on a tongue* of black shale thrust between the hard slates and granite, and the instantaneous change from rugged sterility to verdure and luxuriance is most striking. Walnut trees almost hide the white houses, and above the village smooth green pastures, here and there streaked with dark outcrops of shale, lead up to the grassy† Col de Venos, where the smooth rounded turf-slopes contrast remarkably with the serrated cliffs on each side.

Heated by the pull up the hill in the hot sun, we turned into the little inn at Venos. We found the *salle-à-manger* an upstairs room with a bed in it, opening out on to a vine-covered balcony, containing oleanders in full flower. In the house we noticed a handsome bureau, and other pieces of quaint old furniture, little to be expected in so small a village. Perhaps they were the results of the break-up of one of the old chateaux we had passed between Grenoble and Bourg d'Oysans. An old lady, girt with a huge pair of scissors by way of chatelaine, assisted by a younger damsel, brought us a lunch of bread, cheese, sausage, and excellent honey, for which, with a bottle of tolerable red wine, we paid 1f. 50c. each. Before starting, we

* See Professor Forbes' "Excursions in Dauphiné," p. 267, for a detailed account of this deposit.

† Mathews, who crossed the col and slept at Venos, writes to me: "I left Frenet at 2.45 P.M. on the 12th, reached the col at 4.45, and Venos at 5.45. The slope is gradual on the side of Frenet; there is a grassy plain on the top, and a steep descent towards Venos. Paquet's inn at Venos is very good for Dauphiné."

were informed that it was doubtful whether we should get any white bread at St. Christophe, so I purchased a large loaf, like a magnified "*petit pain*," and buckled it on to my knapsack.

Leaving Venos we descended again to the river, and, crossing over to the right bank by a little bridge, came, before long, upon a wonderful scene. The road enters a narrow gorge overhung with steep mountains; years ago, the peak of one of these fell and filled the valley with its ruins. It is the wildest scene of desolation I ever saw: the celebrated bergfall of the Diablerets cannot at all compare with it. The mountain sides are scarred and barren, the road winds among huge blocks, piled pell-mell one on another, the torrent frets and roars among them far below, while unstained splinters and fresh seams on the cliffs show that there is still a chance of a like accident. At the wildest spot the road crosses the stream over a natural bridge, formed by huge slabs, that have fallen right across it. On leaving this place, the path, after crossing a gravelly flat, ascends a hill, to avoid a deep gorge through which the torrent rushes. St. Christophe is now seen, but the road descends to cross the torrent from the Vallon de Selle, and then ascends to the village. After some little trouble we discovered the auberge of St. Christophe, and entered it to seek night-quarters and tidings of Mathews. The dirty kitchen, with its filthy bed and diminutive den beyond, were very unpromising; but the people of the inn informed us that the guest-chamber was separate from the house. We crossed the road to a small stable, above which was a room, approached by a rude outside staircase. There was one very tolerable bed therein, and they promised to make up another on the floor. Hearing that Mathews had not appeared, and that the quarters at La Bérarde were very

bad—in their own words, “there was no inn, but a *grange*”—we determined to sleep here, and stroll on to La Bérarde next day. A slight arrangement soon made the room tolerably comfortable. Meat was not to be got, but an omelette was forthcoming, with bread and honey. After dinner we went out to explore, and fell in with the curé, who recommended us to follow the path by the side of the stream, which we crossed before entering the village. We



THE MOUNTAINS OF ST. CHRISTOPHE.

did so till we came to a mill, which he mentioned as *the* point of view. It is but a short distance above the road, and no one should pass by without paying it a visit. The stream comes rushing out of a narrow gorge, and tumbles down a series of cascades into the valley below. A snowy peak rises on the opposite side of the valley, and there are excellent views from several places of the mass of mountains which divide the upper part of the valley into two

branches, just as the Mischabel does the Visp Thal. The upper of these two valleys is called the Val de Vénéon, and leads to La Bérarde; the lower, the Val de la Muande, by which a pass leads to Riou du Sap, in the Val Godemar. I made a sketch of the group looking down the latter valley, from which the preceding woodcut is taken. I tried in vain to obtain the names of the peaks—"I do not know," or "they have no name," were the usual replies. Next day, as I was walking to La Bérarde, a peasant told me that one of them was called "Oursilion." As far as I could understand from the man's *patois* he applied the name Oursilion to the highest peak. The only one named on Bourcet's map is the Tête de l'Ours. Thinking that in all probability these mountains are identical, I have placed the Tête de l'Ours a little farther back on the map than Bourcet does, in the position (as I believe) of the highest peak.* Both as regards grace of outline and beauty of colour, they are an unusually attractive group of mountains. I imagine that the highest point is about 11,000 feet above the sea, and could be reached without difficulty.

Gun and pistol shots woke us up next morning to a thorough wet day. On inquiry, we found that the noise was in honour of a wedding about to be celebrated that morning. The church bell began, and one by one the country people came dropping in, each protected by a huge crimson umbrella. The shots became more frequent, the children and old folk clustering under the projecting eaves

* See also "Le Alpi che cingono l'Italia:" Torino, 1845. Quadro di Celtezze, p. 800.

Mètres	Authority	Latitude	Long. E. of Paris
Monte Ollan 4,212	Héricart de Thury	44° 53' 0"	3° 55' 0".
4,212 mètres = 13,819 English feet.			

The author of this work places Monte Ollan at this identical spot. This, I think, must be a mistake.

of the cottages to see the sight. At last they came — the wedding party — some twenty persons, splashing along the rough street, the bride resplendent with white ribbons, and the bridegroom awkward in a new coat, all under the same huge "mushrooms," mostly of a bright crimson colour. In honour of the festive occasion a sheep was killed, and we were able to get a leg of mutton for dinner.

We started for La Bélarde in the rain after dinner, but the clouds soon broke, and we had tolerable views of the mountains above La Bélarde. It is a beautiful walk; more than one fine waterfall is seen; and after losing sight of the Tête de l'Ours and entering the Combe de Bélarde, the wonderful range of crags forming the N.E. boundary of the Vallon de Vénéon begins to appear. The first of these, as seen from Les Etages (about an hour from La Bélarde) is well figured in Professor Forbes' book.* We arrived at La Bélarde after about three hours' walking, and went to the house of one Rodier, who acted as guide to Professor Forbes. This was a dingy single-roomed cottage, containing two indescribably dirty beds. An old man (the Professor's guide), in a mangy suit of sheep-skin, sat on one side of the fire, an old woman, encrusted with dirt, on the other. Their son, a man about thirty, and his wife, were sitting near; on the floor was a cradle containing a naked baby, safely strapped down; close by it a trap-door

* A pass comes down the valley on the left hand of the picture (Vallon de Bonne Pierre), from Pied du Lautaret, or from Le Casset, near Monétier. I am told it is not difficult. E. de Beaumont says of it, "Il y a notamment un passage qui conduit du Pied du Lautaret à la Bélarde par le vallon de Larp, d'où sort une des sources de la Romanche. On monte sur le glacier qui descend au nord-nord-est vers Larp, et, après avoir cheminé sur ce glacier pendant quelque temps, on arrive sur des roches découverts, au milieu desquels on descend vers La Bélarde."—*Annales des Mines*, troisième série, tom. v. p. 14. Ladoucette also says of a pass, probably the same: "(Les glaciers) occupent le passage qui menait de Vallouise à la Bélarde en Oysans, et le chemin qui allait de St. Christophe au Casset."—*Histoire des Hautes Alpes*, p. 9.

led down into a sort of cellar, from which a blear-eyed girl poked up her head; --- throw in a stray child or two, some rude furniture, and a general coat of dirt, and you have the best house in La Bérarde. We determined to give Mathews a day's law, and to spend the morrow in an excursion to the Col de Sais, from which we expected to get a good view of the Pelvoux and the neighbouring country. Rodier, *fils*, professed himself well acquainted with all the passes; but our surprise may be imagined when, on coming to the finance question, he demanded fifteen francs for an ordinary day's work, forty-five for crossing one of the cols, and half that price for going to the col and back. We of course protested violently against the absurdity of charging more for his comparatively low passes than for those of Zermatt or Chamounix; but in vain: for less than this he would not budge—nay, he took up high moral ground, and descanted on the extraordinary difficulties of the Dauphiné Alps, and the great peril he ran by accompanying us. We were consequently obliged to yield.

Soon after dark we retired to the *grange* at the back. It consisted of two rooms, containing grain, straw, tools, and stores of various kinds, including a large hanging-shelf of black bread, made up in great cakes as large as a cheese; a sheet and some blankets had been spread in one corner, on which we lay down, with our knapsacks for pillows, and should have done very well, had not certain agile insects effectually "murdered sleep."

The morning was cloudy but cold*; and as there had been a sharp frost in the night we had hopes of a fine day, and after some little delay started at 6.20 A.M. We walked rapidly up the narrow valley, passing by the place where

* A minimum thermometer hung outside registered -4° Cent. or 24.8° Fahr. during the night.

the path to the Col de la Tempe turns off to mount precipices apparently almost perpendicular. Beyond, the huge crags of L'Aléfroide tower above us, and in front the two arms of the Glacier de la Condamina, descending from either side of the snowy pyramid of Mont Gioubernet, unite and fill the head of the valley. Up the left-hand arm a pass formerly existed to the Val Louise, up the right is the Col de Sais. To the right of the Col de Sais is Mont Chardon*, and before it the lower summit of the Pointe du Chiare. These two mountains separate the Glaciers de la Condamina and du Chardon. Professor Forbes says that it is also possible to reach the Val Godemar by this latter glacier.† We arrived at the foot of the glacier after about an hour and a quarter's quick walking, and got upon it without difficulty, as it was covered at the side with old snow-beds, the remains of avalanches. We were rather surprised at seeing fresh foot-prints on the snow; but Rodier said that they were made by a shepherd who had gone to look after some sheep on the side of the Pointe du Chiare, and presently we saw him working his way up the rocks on the right.

In each of the two arms of the glacier there is an ice-fall just before they unite. In the one to the left the veined structure was unusually conspicuous at a point where the mass of ice was forced through a narrow gorge, and the lines were nearly vertical. We were now getting near the ice-fall on our own branch of the glacier, and saw that it would be necessary to turn it by climbing the rocks on the shoulder of the Pointe du Chiare.

We halted for refreshment at a heap of stones, part of

* Mont Chardon is, I think, the same as the Montagne de Vassivière of Bourcet. The Glacier du Chardon is in the valley, called by him Vallon de Clôt Chatel.

† "Excursions in Dauphiné," p. 275.

a small moraine, before we left the glacier, and then took to the rocks. These, though steep and requiring care, would not generally be found at all difficult ; but on this occasion they were at times a little troublesome, being covered with fresh snow, which hindered us from seeing where there were loose stones. We climbed on for a good while, gradually working round the shoulder of the mountain, till at last we found ourselves above the worst part of the ice-fall, and nearly on a level with the upper basin of the glacier. It was still, however, rather steep, and broken by large transverse crevasses disagreeably masked with fresh snow, beyond which smooth slopes led up towards the col. Here, to our surprise, Rodier stopped, and said that we could not go any farther. We asked why. He said the glacier was too much crevassed, and the crevasses covered with snow. To this, of course, we replied, "then use the rope." He produced it, and, to our disgust, we found it was only a common mule-rope about 12 feet long. Of course I ought to have seen to this before starting, but I was so taken in by the high value that the fellow set on himself, that I only just glanced at his bundle to see that he had not forgotten the rope, and did not examine it closely. Going back, however, was of course out of the question ; so, paying no attention to his remarks, we set to work to find out a way among the crevasses. After a little trouble we thought we saw one ; and while debating on the practicability of the worst bit, spied the fresh track of a chamois on the snow over it. Concluding that where a chamois could go we could probably follow, and having persuaded Rodier to make the attempt, we set off at once, walking in line, and grasping the rope with one hand like a balustrade, in the hope that it might be of some use if anyone broke through. By dint of sounding and walking as if treading on eggs, we got clear

without the slightest mischance, and began a long pull up the snow-slopes of the upper part of the basin. These were not very steep; but the new snow was so soft that we were quite knee-deep. Before long Rodier again stopped, and declared himself exhausted with the fatigue of making the steps. He certainly looked very miserable, though he had not done half what a Chamounix or Zermatt guide does as an ordinary day's work; so we administered brandy and sent him to the rear, dividing the remainder of the work between ourselves.



L'ALÉFROIDE (PIC SANS NOM).

At 11 A.M. we stood on the col, having done the journey at a good pace. The view is very fine. Turning to the right, a rocky shoulder of Mont Chardon cuts off all view in the direction of the Tête de l'Ours; beyond this appears the range above La Bérarde, with the steep ascent to the Col de la Tempe, up which we hoped to climb next day; next comes a gap with a short glacier, out of which projects a singular pointed rock, like a shark's tooth; then rises a tremendous cliff, towering into the sky, a mass of jagged pinnacles streaked here and there with snow, and

culminating in one flame-like point some 3000 feet above us. It is one of the grandest things I have ever seen in the Alps; for the sides of the valley are so steep that it appears to rise right away from the bottom in a vertical precipice of some 8000 feet. I made a hasty outline, which may give a very faint idea of the actual peak. This, according to books and maps, was the Pelvoux; but on putting the question to Rodier, he asserted that it was no such thing, but L'Aléfroide, and that the actual Pelvoux could not be seen from the valley of La Bérarde. At the time we hardly believed him, but he was undoubtedly right; so that no one for the future need go to La Bérarde, as we did, with the expectation of seeing Mont Pelvoux. A snow-field lies between L'Aléfroide and Gioubernet, feeding the other arm of the Glacier de la Condamina, and a small depression in its edge marks the spot where formerly they used to pass into the Val de Sapienière.* Rodier asserted that the glacier had now rendered the passage impossible; but I must say that I feel very incredulous on this point. On the west side there is nothing to cause any difficulty except an ice-wall a little below the col, and this, I believe, could be turned. Unless I am mistaken, I saw the whole of the eastern side of the pass a few days later from a point on the Pelvoux, and feel sure that no difficulties exist on that side. It would certainly be a shorter route into the Val Louise than the Col de la Tempe.

From the point on which we were standing, a sharp snow arête led up to the summit of Gioubernet, which we felt much tempted to follow. However, as we should have had to go without Rodier, and were very anxious to be in good condition for the morrow, we refrained, much to our after regret; for we should doubtless have had a much more ex-

* Probably this is the pass mentioned by Ladoucette in the passage already cited.

tensive view, and have cleared up several points on which we are still in doubt. Our view of the descent from our col into the Val Godemar was limited to the sloping snow-field at our feet, over which we looked down into the head of the valley, upon rocks streaked with snow, green pastures, and dark pines. A large snow-mountain* lay on the other side of the valley, and several ranges of mountains, streaked here and there with snow, but of no great height, and without any conspicuous peak, stretched away into the distance. A cold wind swept over the col from the other side, and obliged us, after a short stay, to run down the last snow-slope to a more sheltered spot. After a short rest we carefully retraced our steps over the snow till we regained the rocks, whence we descended, without accident, to La Bérarde, arriving there at 3.30 P.M. Here we were welcomed by Mathews, who had slept at Venos the previous night, and walked up that morning, accompanied by his guide, Michel Croz of Chamounix. After telling him the result of our observations, that L'Aléfroide, whether Mont Pelvoux or not, was hopeless from that side, we determined to cross the Col de la Tempe next morning, in order to see what the other sides of the Pelvoux were like. This gave us a fresh specimen of the honesty of the Rodiers. During the morning we had engaged young Rodier to show us the way over the col, without his making the slightest objection to going. While Mathews was waiting for our return, he began to talk to the old man about the pass, and was told by him that his son would certainly not go across it, as he was not very well, and did not wish to sleep away from home. Mathews then said that in that case he supposed he must accept the old man's services, as no one else knew the pass.

* Probably the Mont Garroux.

When he found that the son had promised to go with us, he told the old man that his son was going, and that therefore he should not want him. Upon this the two scoundrels laid their heads together, and refused to stir unless both were engaged. To this, of course, we refused to submit, for the old man was so decrepid that I doubt much whether he could have got up to the col, even if his share of the provisions had been carried for him. At last, after a long "row," in which we, backed by Croz, spoke our minds very freely, the matter was arranged by taking the pair at a reduced price. This done, we made some chocolate in a frying-pan, and in due course retired to bed in the hay-loft, where insect life was much less abundant than in the "grange," and consequently sleep not absolutely impossible.

Next morning it rained heavily, so that crossing the Col de la Tempe was out of the question. A wet day in La Bérarde seemed too dismal a prospect to be endured; so we shouldered our knapsacks and walked through the rain to Bourg d'Oysans, whence we drove by Briançon to the entrance of the Val Louise. The weather again proved unpropitious, and after passing two nights and a day in a cave on the highest pastures, we made an attempt to ascend the Pelvoux, which was defeated by a dense mist.

The best way for ordinary travellers to visit the valley I have been describing, would be to quit their carriage at Bourg in good time in the afternoon and walk on to Venos. The next morning they might take a porter with a day's provision, and walk up to the foot of the Glacier de la Condamina, returning to Venos to sleep. This would probably be a journey of twelve hours; so that those who do not mind rough sleeping-quarters might pass the first night

at St. Christophe instead of Venos. This would shorten the day's work by two hours or more. On the third day they might, instead of returning to Bourg, cross the Col de Venos, and meet their carriage at Frenet, on the high road. By starting from Venos early, it would, I think, be possible to reach Briançon the same night. Though the accommodation in this district is far inferior to that which travellers now find in almost every part of Switzerland, yet I am sure no one who turns aside from the high road to explore the Val de St. Christophe will regret the time he has spent there, if only he is fortunate enough to have fine weather, and not, as we had during our whole stay in Dauphiné, two days of rain or mist to one of sunshine.

NOTE.

Any one who has Bourcet's map will see that in our map we have deviated considerably from his. I am responsible for the part to the S. and W. of the Pelvoux, and therefore wish to state that, though I may be wrong in some of the changes, I have not altered Bourcet's map in any case without being absolutely certain that it was incorrect. In one or two places near the Col de Sais, it is quite unintelligible: this I found by comparison on the spot; but as the bad weather prevented my getting panoramic views, it is possible that I may have, in one case, wrongly fitted together opposite sides of the mountains. No change, however, has been made without consulting my companion, Mr. Hawkshaw, to whom I am much indebted for the use of his notes and sketches, especially for a sketch map of the N. side of the Col de Sais. I subjoin a table of heights in English feet of some of the places mentioned, taken from Professor

Forbes' work ; together with two calculated from barometric observations by Mr. Mathews, and kindly communicated to me.

	Forbes	Mathews
Bourg d'Oysans	(above) 2400 ft.	2388
Vénos	3230	
St. Christophe	4800	
La Bérarde	(about) 5550	5669
Col de Sais	10,224	

4. A SKETCH OF THE PASSAGE OF THE COL DE LA SELLE FROM LA GRAVE TO ST. CHRISTOPHE.

BY F. ELLIOT BLACKSTONE, B.C.L., F.R.G.S.

ON September 26th, 1855, I left Grenoble with L., a college friend, for a few days' excursion in the Alps of Dauphiné.

The previous week I had hurried across the Col de Lautaret from Briançon to Grenoble, in a long day's drive of fifteen hours, and had been so surprised and delighted with the grand scenery on the route, that I determined to devote a few days to its exploration.

As we intended to return to Grenoble within four days, and had reason to believe that the country was very wild and guides scarce, we took nothing in the way of baggage. A char carried us from Grenoble along a straight and somewhat tedious road, as far as Chichilienne, whence we walked on through the wild defile called the Combe de Gavet to Bourg d'Oysans, and found very fair accommodation at the Hotel Josserand.

The weather was magnificent, and continued so for the next three days. At 6.30 on the morning of the 27th September, we started for La Grave in a chilly fog, which rose from the neighbouring flat marshy ground, and proved the prelude to a glorious day, without a speck of cloud.

It is a pity that this excellent carriage-road up the valley of the Romanche is not more frequently traversed by English visitors; for those who do not mind rather

rough accommodation, would find themselves well repaid by the savage grandeur of the defiles of Les Infernets and the Combe de Malval, through which the road ascends to La Grave. These gorges are not inferior to that of Gondo on the Simplon; and the first contains a gallery far longer than the Grand Gallery on that well-known route; while the waterfall that pours over the cliffs of the Combe de Malval on the left as you ascend, called *Le Saut de la Pucelle*, equals the *Staubach* in height, and surpasses it in volume.

There is probably no carriage-road in the Alps, except the *Stelvio*, and perhaps the *Maloya*, which passes so close to glaciers and commands such near views of them. Immediately in front of La Grave rises the immense peak called the *Aiguille du Midi de la Grave*, streaming with glaciers, from which, during our midday halt, we heard avalanches thundering down as often as the *Oberland* traveller does from the cliffs of the *Jungfrau*.

The annexed view, taken from my sketch made on the spot, gives an idea of the striking situation of this village, which has an additional interest in having been an outlying hamlet of *Felix Neff's* district. Compared with their Swiss rivals, these mountains are peculiar in their excessive steepness and in the sharpness of their summits, being equalled in this respect by the *aiguilles* of *Chamounix* alone. These characteristics, and the scarcity of pines, those natural barriers against avalanches, cause a marked absence of the high pastures and *châlets* which form so beautiful a feature of the Swiss Alps.

In the evening I walked on almost to the summit of the *Col de Lautaret*, and sketched the snowy *Mont d'Oursines* at the head of the sources of the *Romanche*. I hope the auberge, *chez Juge*, at La Grave is improved since 1855, as at that period its resources were decidedly limited; no

meat being forthcoming, except some particularly dry *jambon*, and the usual portion of tough goat, invariably inflicted on you in the Alps as chamois, and charged accordingly. The hostess, too, at first maintained that she had no milk; but as I had passed a drove of cows in returning from the Lautaret, I objected to the absence of the one good thing always to be counted on at a mountain village, and eventually she produced some. We tasted



AIGUILLE DU MIDI DE LA GRAVE.

their bread: it is baked only once a year, is the colour of walnut-wood, sour beyond conception, so hard that it can only be chopped with a sort of cleaver, and requires, I should think, full ten minutes' mastication to the cubic inch. Well for the natives that they possess the "*dura messorum ilia!*" When we inquired why they were content to expend their dental energies on this execrable compound, while they were able at the same time to

provide ordinary bread in the summer for travellers, the only answer was a shrug of the shoulders, and "*c'est l'usage du pays, Monsieur.*" Before going to bed we made arrangements through the landlord with a chasseur to take us over the opposite range to St. Christophe, in order that we might see something of that valley, and avoid traversing the same ground again in returning to Bourg d'Oysans. The point we wished to make for was La Bérarde at the head of the valley of St. Christophe; but it appeared doubtful whether there was a practicable passage in that direction, and at any rate the distance and difficulties would have been too great, as it was my first summer in the Alps, and my friend had never been on a snow-mountain.

The sleeping accommodation of the auberge was limited, consisting of two small rooms, one opening out of the other,—the inner one, which we secured, containing two beds, the outer three. A primeval simplicity of manners, and a disregard of the usual conventionalities of civilisation, appeared to prevail in the domestic arrangements, as we found that the occupants of the outer room, through which we had to pass, were two women and a man. At 7, the next morning, we set off with the chasseur, who took his gun with him. After crossing the Romanche, the path lay up the steep slopes below the glaciers of the Aiguille du Midi, bearing gradually to the right. These slopes were clothed at intervals with scanty pastures and a few firs, among which our guide shot an ortolan. Just before reaching the snow-fields, we had to climb a high and steep ridge of rocks, much resembling that leading to the Hörnli at Zermatt. On reaching its summit we found ourselves looking down from a nearly vertical cliff upon a fine glacier of remarkably pure and blue ice, which sloped away to the right towards the Combe de Malval, in

whose depths our road of yesterday was visible far below. A short walk along the top of the ridge to the left brought us to the snow-fields. Some of the rock hereabouts appeared of a very singular formation, resembling yellowish brown clay liquefied and then hardened again.

The snow-fields proved very soft, so that it required more than two hours to cross them; and as we had lost much valuable time in frequent rests during the first ascent under a hot sun, the Col de la Selle was not reached till 2.30 P.M. It lies beyond and to the right of the rocks, on the extreme right of the sketch from La Grave. The view was one of great extent and most savage grandeur, especially in the direction of Mont Pelvoux, whose cluster of rugged peaks loomed through the mist on the S.E. To the N.W. appeared the group of sharp summits around the Grande Chartreuse, and beyond them the Jura; N.E. Mont Blanc, nearly in front of which was a fine point behind La Grave, called there the Pyramide. Above us, on the E., towered a peak, which I certainly supposed was the Aiguille du Midi, but, according to Bourcet's map, there must have been one between, called by him the Pointe du Grand Glacier. A little to the right of this, between it and the Pelvoux, we saw what I think was the Viso. Scarcely had we had time to glance round this panorama when a snow-storm commenced, and compelled us after a short rest to commence the descent, which proved to be a decidedly awkward piece of work. A few yards from the col, we stepped over the edge of a vast semicircular hollow, rather funnel-shaped, like some corries I have seen in the Scotch Highlands, at the bottom of which, below precipices whose upper ledges only were visible, lay a large glacier, the source of the stream joining the Vénéon at St. Christophe, called in some maps Le Torrent du Diable. This glacier we expected to reach in an hour and a half, but

so mistaken was our estimate of the distance, that it took more than double that time. The upper part of the slope was inclined at a very steep angle, and was covered with a thin sheet of snow, the surface of which had partially melted and frozen again, so that its passage would have required the greatest caution, even if our party had been larger and more experienced. As it was, we had neither rope nor axe, and I only wonder that we got down without a worse accident than happened to L., who after a few steps slipped and fell: his alpenstock flew out of his hands and instantly shot down the slope, and he himself followed it with nearly equal rapidity for about 200 feet, cutting his hands badly on some rocks, and rolling over on his face before he contrived, by some means or other, to stop himself just at the commencement of a rocky watercourse. My hands were so stiff with cold from the driving snow-storm, that my alpenstock soon followed L., whose headlong descent I should in consequence soon have imitated, had not the guide, by keeping just below me, managed to stop my repeated slips without once losing his own footing. At last he managed to pick out some steps with the point of his pole to a slope of shale, at the bottom of which we rejoined L., who, as we found to our great relief, was not seriously hurt, though somewhat bruised and severely shaken, and who had succeeded in recovering both the alpenstocks. The guide said he had never before found this slope in so dangerous a state, as the snow usually melted away altogether; but this year its disappearance had been prevented by the lateness of the summer. A succession of steep bare slopes and rocks, down which it was often rather awkward to clamber, brought us at length to the foot of the descent near the terminal moraine of the glacier. When about half-way down, the guide suddenly cried "*Voilà beaucoup de chamois*," and pointed out a herd

of fourteen about 500 yards off to the left. As they were worth forty or fifty francs a head, I consider it much to his credit that, in consideration of the lateness of the hour, he resisted the temptation to leave us and try to stalk one of them, especially as we suggested the idea, being entirely ignorant of the distance yet to be traversed before reaching St. Christophe. He only asked fifteen francs for the day's work,—an extremely moderate charge, considering the



SKETCH-MAP OF ROUTE.

distance out and home. We were soon benighted, and had to descend the last two hours in the dark by a very rough path alongside of the furious torrent. This gorge, called the Vallon de Selle, is utterly savage and barren,—the very type of desolation,—without a tree or a bush, and with very little grass. High snowy walls, literally bristling with aiguilles of extraordinary abruptness, enclose it on both sides. St. Christophe was reached at 8.30 P.M., and,

thoroughly tired with our walk of thirteen hours and a half, we were glad to find the only two beds this miserable village could afford unoccupied ;—as to the couches of the natives, they are nothing but hay. Our sleeping quarters were in a sort of loft, reached from the outside by a step-ladder, and there we made a tolerable supper with the guide. As this pass has no name at present, I propose to call it the Col de la Selle, after the valley. Judging from the known altitude of La Grave and the Aiguille du Midi, it must be, I think, not less than 10,000 feet high ; but I hope it may soon be traversed by some of my more scientific colleagues, and its elevation accurately determined. It presents no real difficulty, except when the commencement of the descent is in the state in which we found it, and a good pedestrian ought to cross it in about ten hours and a half.



MONT PELVOUX FROM ABOVE LA BESSÉE.

5. THE ASCENT OF MONT PELVOUX.

BY EDWARD WHYMPER.

"Des hautes montagnes, couronnées par des glaciers où se sont entassées, à des profondeurs immenses, les neiges presque éternelles qui dominent des pics de rocs nus et décharnés, s'élançant comme pour atteindre les cieux; tous les aspects, toutes les expositions et les températures; tout ce qu'il y a de plus varié et de plus monotone, de plus curieux et de plus intéressant, de plus imposant et de plus simple, de plus riche et de plus pauvre, de plus riant et de plus triste, de plus beau et de plus horrible: voilà le département des Hautes Alpes."

LADOUCKETTE.

We are approaching so fast that millennial period when all countries will be exactly alike, and national manners and customs will be reckoned with the things of the past, that the tourist has already some difficulty to find near home a district in which he may enjoy a thorough change of scene with a thorough change of habits. But

though this has been a continual source of complaint, certain comparatively accessible districts have been almost overlooked, and prominently among these is that large portion of the ancient province of Dauphiné, comprising the whole of the department of the Hautes Alpes, and the southern half of that of the Isère. Some few travellers from time to time have endeavoured to draw attention towards it, but it remains at the present hour not much better known than the interior of Africa.

The most *blasé* man cannot complain in Dauphiné of want of novelty, for among the people he will find customs not to be met with in any other part of Europe; and in the mountains, scenes equal in beauty and grandeur to any in the Alps. It is, in fact, a perfect mine, full of treasure, and offers a noble field for the exploration of travellers—or tourists like myself, whose time and means will not permit them to indulge in more extensive rambles.

Before commencing my narrative of the ascent of Mont Pelvoux, it will be as well to refer the reader to the map, while I give a brief description of the general features of this district.

Rising within the rude parallelogram bounded by the towns of Bourg d'Oysans, Briançon, Embrun, and Gap, is a vast group of mountains broken up into detached masses. The highest of these is a great ridge bearing nearly north-east and south-west. It commences in the south with a tooth of pyramidal form and great height, with wall-like sides, on which the snow cannot rest, more narrow and wedge-like than the Eiger, and precipitous as the Matterhorn—'tis the *Montagne Sans Nom*, the highest in Dauphiné. The ridge sinks, but again rises, and this time in the form of a huge sugar-loaf, with the top cut off, hollowed out and filled with snow. Round the edge, and at nearly equal distances, stand five peaks of different heights; these

form the Mont Pelvoux. To the north of this, the Glacier Noir comes sweeping round, and beyond it the graceful Montagnes des Agneaux appear, glittering with snow and ice. More to the west the Montagne d'Oursine rises in all its splintered grandeur, and last, but in situation the finest of all, is the Aiguille du Midi de la Grave. These are the principal summits, most of which are more than 13,000 feet in height.

From this group, a perfect forest of valleys radiate in all directions, which vie with each other in singularity of character and dissimilarity of climate. Some, the light of the sun can never reach, they are so deep and gorgelike. They are chill and oppressive in their solitude; and at times the traveller is surprised to find great beds of snow under the shadow of their cliffs. In others, the very antipodes may be found, in temperature more like the plains of Italy than Alpine France. This great range of climate has a marked effect on the flora of these valleys; sterility and nakedness reign in some—stones take the place of trees—débris and mud replace plants and flowers; in others, in the space of a few miles, one passes vines, apple and pear-trees, the birch, alder, walnut, ash, larch, and pine, alternating with fields of rye, barley, oats, beans, and potatoes. All of these valleys are short, and most of them deep and narrow, so that good views of the great mountains are rarely to be had from low elevations. There are few mountains, I suppose, in the world, so isolated, and yet so shut in and difficult to be seen, as the Pelvoux. It is true, valleys lead up to it in several directions, but they are vagrant and capricious; you advance a few miles along one, and find it turns sharply to the right—a few miles more, and back it goes at nearly right angles to the left. Thus, no long perspectives are to be seen with one's mountain closing the view, and

indeed I know of but two points — La Bessée and Mont Dauphin — from which the Pelvoux may be seen from a less elevation than 4000 feet. Added to this, the season in Dauphiné is very short. The inhabitants universally testify that it is seldom fine enough for excursions in the high mountains before the last week in July, or after the middle of August. Taking all this into consideration, it is not surprising that this group of mountains is so little known, or that so few travellers have described it.

The chief authority for the geography of this district is M. Elie de Beaumont, Ingénieur-en-chef des Mines, who, in his "*Faits pour servir à l'Histoire des Montagnes de l'Oisans*," has given a full description of this group of mountains, but he is frequently incorrect.* For instance, after stating that the Mont Pelvoux was not entirely inaccessible (as the French engineers employed on the survey for their great map had reached the summit to which the name of the Grand Pelvoux properly belongs†, and saw from it, at the distance of 3000 mètres towards the north-west — that is to say, in the direction of La Bérarde — another more elevated peak, which summit is called the Pointe des Arcines, or des Ecrins, and ought, in reality, to be considered as part of the "massif" of Pelvoux, and as forming of it the culminating point), he goes on to say, on page 362, that "one of the points from whence I have had the best view of the arrangement of these mountains, is from the valley of the Durance, in the neighbourhood of Guilestre." Guilestre is two miles from Mont Dauphin. "I annex a sketch of their appearance from this side. The Grand Pelvoux, marked *a*, seems formed of a great shell of gneiss,

* It should be observed that he says he follows General Bourcet's map, which is enough to account for some errors.

† This is an error; the engineers' peak is *behind* the Grand Pelvoux.

which springs from under the nummulite of which the bottom of the valley of Val Louise consists, and which,



rising towards the north, attains a greater height than all the *montagnes voisines*." From this quotation one might suppose that he here refers to the highest point of the group, and consequently to his Pointe des Arcines; but the word "*voisines*" can be interpreted so very differently that one would be left in uncertainty, if he did not say, a few pages further on, "When we look at the group now occupying us . . . we see a mountain *e* between Entraigues and La Bérarde, remarkable for its sharp angles and its square forms. . . . It looks like a great Gothic cathedral, slightly inclined in the direction of its length." This mountain I recognise at once, by his description as well as from his outline, as that which is shown on the left of the Pelvoux, as seen from La Bessée, in the engraving at the head of this paper.* It will be observed that M. Beaumont properly speaks of this mountain as one apart from the Pelvoux. But this is done more distinctly when, on the next page, he says that the Pelvoux can be recognised perfectly from a distance with this mountain on the left. "From the Col Longet, one completely recognises the Grand Pelvoux, which looks white from the glaciers which cover it; on its right the Montagnes d'Oursine and on its left the granite mountain which looks like a Gothic church;" and on the following page he repeats the same statement.

* The point from which this sketch is taken is marked A on the map.

"They are also well seen from Mont Pilas (Loire), and from Mont Mezenc (Haute Loire), towering over all which surround them. From Pilas especially, an eye accustomed to their structure recognises their principal details with surprising exactness. Placed in a direction almost exactly opposite that of Guilestre and of Col Longet, one sees, for instance, to the right of the Pelvoux, the granite mountain marked *e*, &c." This reiterated account of the mountain near the Pelvoux leaves no doubt but that M. Elie de Beaumont, when speaking of the Pelvoux, on p. 362, did imagine that the highest summit of the group as fixed by the engineers was that which he marked *a* in his sketch. The reader is requested to observe this, as I shall return to it presently.

After M. Elie de Beaumont, comes Professor Forbes. In his "Norway and its Glaciers," he gives an account of the passage of the Col de Sais. He says, at pp. 377-8, "A gentle snow-slope led up to the summit of the pass. . . . There rose just opposite to us, and to a height of more than 3000 feet above us, the pyramidal summit of the Mont Pelvoux itself, which predominates over the whole." Professor Forbes remarks also, that the Mont Pelvoux is the highest mountain between Mont Blanc and the Mediterranean, and that the Pointe des Arcines is its loftiest summit. From these two authors most of the current statements about Mont Pelvoux have, I believe, taken their rise, and it has become at last a settled idea, that this mountain is the highest in France.

Now, in fact, both of these gentlemen are in error. Elie de Beaumont is, first, in fixing the highest point of the group at *a* in his sketch, as in reality this point *a* is not so high as *e*; secondly, when he speaks of the granite peak marked *e* as a separate mountain, being unaware that it is the very mountain that he calls the Pointe des Arcines,

as it is the one which the engineers saw at the distance of 3000 mètres, and to which they assigned 4105 mètres in height; and, thirdly, in giving the name *Pointe des Arcines* to this mountain, for, as he elsewhere says, that is the name of the highest peak of Pelvoux, while he himself repeatedly states that this mountain *e* is separate and distinct.

In like manner, Professor Forbes is mistaken when speaking of the view from the Col de Sais. For the mountain to which he refers is not the Mont Pelvoux at all, but is that which Elie de Beaumont marked *e*, is that which may be seen on the left of my engraving, and of which there is also an illustration in Mr. Bonney's paper, at p. 209 in this volume.

The reader will learn presently my foundation for asserting that the granite mountain marked *e* is that to which the engineers referred, and enough to show that this virgin peak, which on the side of La Bessée is called the *Montagne Sans Nom*, and on the side of Bérarde known as *l'Aléfroide* (a most inappropriate name, causing it to be confounded with the châteaux hereafter mentioned), offers to the Alpestrian who shall ascend it, the distinction of having conquered the loftiest mountain *in France*.

So far as I have been able to learn, attempts to ascend the Mont Pelvoux have not been numerous. The first on record is that of the party of French engineers headed by Captain (now General) Durand, who made it to take some observations for the great French map. They mounted from the side of the Val Sapenière, got to the top of the second peak in height and remained somewhere on it, lodged in a tent, for several days, at a height of 3933 mètres. They took numerous porters to carry wood for fires, and erected a large cairn of stones on the summit, which has caused this peak to take the name of *Pic de la Pyramide*.

In 1859, M. Senon essayed to reach the highest summit, but only got to the edge of the plateau of snow, at the point from which the small glacier commences to stream; he was, I believe, compelled to return by bad weather. And, in the middle of August, 1860, Messrs. Bonney and William Mathews tried it from the same side, but were likewise defeated by the weather. They passed two nights under a fallen rock which bears the imposing name of "Cabane des Bergers de Provence," but is only a boulder with a hole under it, and on the third day they were tempted upwards by an appearance of fine weather. It again changed when they got up to 10,430 feet; clouds surrounded the party, and their local guide refused to advance, so they were reluctantly compelled to return, and shortly afterwards left the district.

I started for this unknown region early in July 1861, and, with knapsack on back and ice-axe in hand, landed at Havre, where my appearance on the quay created a slight sensation. "*Sacre!*" muttered a bloated gendarme, nudging his comrade, "*voici un grand militaire.*" "*Ah, oui!*" replied he, thinking himself wiser than his neighbour, "*un sapeur sans doute.*" Here I got my mountain gear passed the custom-house, and sent it direct to La Bessée, whilst I started to make a complete circuit of the French coast. Four weeks later, at Nismes, I found myself completely collapsed by the heat, which was 94° in the shade, and thought it was more prudent to break than to continue my programme; so I took the night train to Grenoble.

I arrived at Grenoble early in the morning, and found that all the places in the courier to Briançon were, as usual, engaged two days beforehand; but this was of little consequence, as I got a place in the diligence to Bourg d'Oysans. Here I found my friend Macdonald, and learnt

that he was going to try the Pelvoux in about ten days. As I was at that moment *en route* for the mountain, I informed him of my intention, and we agreed to meet at La Bessée on the 3rd of August. In five minutes more I was perched in the banquette, and had another dreary night on the road: we took nearly eight hours to accomplish less than thirty miles.

At five minutes to 5 I started from Bourg d'Oysans and got into Briançon at 6; deducting stoppages, it was ten hours' walking. The annexed facts may be useful to travellers:—

Bourg d'Oysans to Freénet . .	11 kilomètres .	Auberge.
.. Le Dauphin 14½	..	. Auberge very bad.
.. La Grave . 28½	..	. Auberge, chez Juge, sleeping quarters pretty good.
.. Top of Col 38	..	. Bread and wine can be got.
.. Monétier .	..	. Several auberges.
.. Briançon . 61½	..	. Hôtel de l'Ours.

The road is very good, with the exception of the first mile descending towards Briançon, which is still unfinished.

The points of view on the Lautaret road are many in number. The gorge of Les Infernets is magnificent in the extreme; and when that and the village of Le Dauphin are passed, the first glacier comes into view, tailing over the mountain side on the right, and, until the summit of the col is passed, every gap in the mountains shows a glittering glacier or soaring peak. High above the road, about two kilomètres below La Grave, there is on the left a fine cascade, which resembles the defunct Pelerins at Chamounix. The vignette on the next page is from a sketch made on the spot.

A short distance above La Grave, on the right, there is a glorious view of some fine snowy mountains up a short valley; I inquired their name of some natives, but they all differed hopelessly—I suppose, however, they

must be the Montagnes des Agneaux. But the finest view of the pass is seen after crossing the col, near Monétier. Monte Viso appears at the end of the vista, shooting into the sky, and, although thirty-six miles away, is a magnificent object; in the middle distance, but still ten miles off, is Briançon with its interminable forts, and in the foreground, sloping down to the Guisane, and rising high up the neighbouring slopes, are fertile fields of corn, studded with villages and numerous church spires.



CASCADE NEAR LA GRAVE.

The next day I walked over to La Bessée and sought Jean Reynaud, the worthy *agent voyer* of the district, whose acquaintance I had formed in the previous autumn. He

had received the packet in which were the necessaries for our expedition, and nothing prevented our starting at once but the absence of Macdonald and the want of a bâton. Reynaud suggested a visit to the post-master, who possessed a bâton of local celebrity. Down we went, but the bureau was closed; we hallooed through the slits, but no answer. At last this official was discovered endeavouring (and with very fair success) to make himself intoxicated. He was just able to ejaculate, "*La France, c'est la première nation du monde,*" a phrase used by a Frenchman when in a state that a Briton begins to shout, "We won't go home till morning" — national glory being uppermost in the thoughts of the one, and home in those of the other. The bâton was produced, but when I saw it my heart sank within me. Imagine a branch of a young oak, about five feet long and three inches thick, gnarled, and twisted in several directions, terminated by a point more like the end of Goliath's spear than a rational bâton — it was, in fact, ten inches long. "*Monsieur,*" said the *chef de bureau*, as he presented it, "*la France, c'est la première nation du monde, par ses*" — he stuck. "*Bâtons?*" I suggested. "*Oui, oui, Monsieur, par ses bâtons, par ses — ses,*" and here he couldn't get on at all. But as I looked at this young limb, I thought of my own, and asked if there really was not a lighter weapon in the village. Reynaud, who knew everything about everybody, said there was not; so there was no help for it, and off we went, leaving the official staggering in the road, muttering, "*La France, c'est la première nation du monde.*"

The morning of the 3rd of August dawned, but no Macdonald appeared, so we were obliged to start without him. We left La Bessée at twenty minutes to 11, the

party consisting of Jean Reynaud, myself, and a porter — Jean Casimir Giraud, *dît* Petits Clous, the shoemaker of the place. An hour and a half's smart walking took us to La Ville de Val Louise, our hearts being gladdened on the way by the glorious peaks of Pelvoux shining out without a cloud around them. We entered La Ville, where we provisioned ourselves. Reynaud kindly volunteered to look after the commissariat, and I found to my annoyance, when we were about to start, that I had given tacit consent to a young wine-cask being carried with us, which was a great nuisance from the commencement. One man tried to carry it, and then another, but it was excessively awkward to handle; so at last it was slung on one of our bâtons, and carried between two, which gave our party the appearance of a mechanical diagram to illustrate the uses of levers.

At "La Ville" the Val Louise splits into two branches, the Val d'Entraigues on the left, and the Vallon d'Alfred on the right; our route was up the latter, and we moved steadily forwards to the village of La Pisse, where I was told lived Pierre Sémiond, who was reputed to know more about the Pelvoux than any other man. He looked an honest fellow, but unfortunately he could not come, and recommended his brother instead. I asked to see him, and an aged creature appeared, whose furrowed and wrinkled face hardly seemed to announce the man we wanted; but having no choice, we were obliged to engage him, and we again set forth.

The mountain could not be seen at La Ville, owing to a high ridge which intervened; we were now moving along the foot of this to get to the châteaux of Alfred, or, as they are sometimes called, Aléfroide, where the actual mountain commences. From La Pisse and upwards, the view of it was very grand. The whole height of that peak, which in

these valleys goes under the name of the "Grand Pelvoux," was seen at one glance from its summit to the base, at least 7500 feet of apparently perpendicular cliffs. Walnut and other trees in great variety gave shadow to our path, and fresh vigour to our limbs, while below, in a sublime gorge, thundered the torrent, whose waters took their rise from the snows we hoped to tread on the morrow.

From this point the subordinate but more proximate peaks appear considerably higher than the loftier ones behind. The Pic des Arcines is just seen on the left hand of the engraving on the next page*, but the Pic de la Pyramide is quite hidden.

The chalets of Alefred are a cluster of miserable wooden huts at the foot of the Grand Pelvoux, and are close to the junction of the streams which descend from the glacier de Sapienière on the left, and the glaciers Blanc and Noir on the right. We only rested a minute to purchase some butter and milk, but Sémond picked up a disreputable-looking lad (who, I fancy, called him "father") to assist to carry, push, haul, and otherwise move the wine-cask.

Our route now turned sharply to the left, and all were thankful that the day was drawing to a close, so that we had the shadows from the mountains. A more frightful and desolate valley it is impossible to imagine: miles and miles of boulders, débris, stones, sand, and even mud; — few trees, and they placed so high as to be almost out of sight; — no vegetation; not a soul inhabits it, no birds are in the air, no fish in its waters; the mountain is too steep for the chamois, the slopes too inhospitable for the marmot, the whole too repulsive for the eagle; not a living thing did we see in this sterile and savage valley for four days, barring some few poor goats which had been driven there against their will.

* The point from which the sketch was taken is marked B on the map.



MONT PELVOUX, FROM THE VALLON D'ALFRED.

It was truly a scene in keeping with the diabolical deed perpetrated here about four hundred years ago—the murder of the Vaudois of Val Louise in the caverns which were now in sight, though high above us.* Their story is very sad. For more than three hundred years they had inhabited these retired valleys in tranquil obscurity; they were peaceful and industrious—troubadours sang their praises†—and, had they been but known, they would have been beloved by all, save those to whom innocence is nauseous, and goodness ever hateful.

The Archbishop of Embrun endeavoured, but with little success, to get them within the pale of his church; his efforts were aided by many others, who, commencing by imprisonments and tortures, at last adopted the more natural method of burning them by hundreds at the stake. The wretched inhabitants fled at last to the caverns in this valley, where, having collected sufficient provisions for two years, they took up their abode. But intolerance is ever painstaking, and their retreat was soon discovered. Historians differ as to the mode of attack, but they agree as to the final result,—they were relentlessly exterminated without distinction of age or sex. More than 3000 persons, it is said, perished in this frightful massacre; the growth of three hundred and fifty years was destroyed at one blow, and the valley was completely depopulated. Louis XII. caused it to be repopled, and after three hundred and fifty years have once more passed away, behold the result,—a race of monkeys. Of one thing I am certain,—they must have been taken by surprise when

* They are marked C on the map.

† "Que non volia maudir ne jura ne mentir,
N'occir ne avoutrar, ne prenre de altrui
Ne s'avengear deli suo ennemi,
Loz dison qu'es vaudes et loz feson morir."

attacked, or else there was treachery. The position of the caverns is such, that a handful of resolute men could defy an army. Steep slopes and precipitous rocks lead up to them for several hundred feet, while above, it is all inaccessible cliff.

There is but little water in this valley, and when you get any it is usually muddy and bad; but we arrived at a splendid little spring about half an hour after we passed the Baume. The situation of this is worth noticing; it is about forty yards higher up the valley, and nearer the Pelvoux than the outermost of a small patch of pines: it is very small, but the quality of the water is excellent. It is marked D on the map. We rested a little and hastened upwards, till we nearly arrived at the foot of the Sape-nière glacier, when Sémond said we must turn to the right up the slopes. This we did, and clambered for half an hour through scattered pines and fallen boulders, when evening began to close in so rapidly that it was time to look for a resting-place. There was no difficulty in getting one, for all round was a chaotic assemblage of rocks. We selected the under side of one, which was more than fifty feet long by twenty high, cleared it of rubbish, and set about collecting wood for a fire, which was soon blazing right merrily.

That camp-fire is a pleasant reminiscence. The wine-cask had got through all its troubles;—was tapped, and the Frenchmen pretended to derive some consolation from its execrable contents. Reynand ever and anon chanted some scrap of French song, and each contributed his share of joke, story, and verse; the weather was perfect, and our prospects for the morrow were good. My companions' joy culminated when I threw a packet of red fire into the flames: it hissed and bubbled for a moment or two, and then broke out into a grand flare. The effect of the

momentary light was magnificent ; all around, the mountains were illuminated for a second, and then relapsed into their solemn gloom. One by one our party dropped off to sleep, and at last I got into my blanket-bag ; it was hardly necessary, for although we were at a height of at least 7000 feet, the minimum temperature was above 40° Fahrenheit.

We roused at three, but did not start till half-past four. Giraud had been engaged as far as this rock only, but as he pressed anxiously to be allowed to go on as a volunteer, we allowed him to accompany us. We mounted the slopes quickly, and in a few minutes got above the trees, then had a couple of hours' clambering over bits of precipitous rock and banks of *débris*, and at a quarter to 7 got to the narrow glacier, *Clos de l'Homme*, which streams from the plateau and nearly reaches the *Glacier de Sapeinière*. We had been working as much as possible to the right, in hopes that we should not have to cross it, but were continually driven back, till at last we found it was absolutely necessary. Old *Sémiond* had a strong objection to the ice, and made explorations on his own account to endeavour to avoid it, but *Reynaud* and I preferred crossing it, and Giraud stuck to us. It was exceedingly narrow—in fact, one could throw a stone across it. At the point we wished to cross, it overlapped the rock, and was easily mounted on the side, but in the centre swelled into a steep dome, up which we were obliged to cut. The inclination was, perhaps, as much as 40°, and the slope not more than ninety feet in length. I commenced a few steps, but Giraud stepped forward, and said he should like to try his hand. When once he got the axe he would not give it up, and here as well as afterwards, when it was necessary to cross the *coulairs* which abound on the higher part of the mountain, he did all the work, and did

it admirably. Chop, chop, chop, and one step was cut (two blows down and one sideways always sufficed), and in an incredibly short time he was at the top of the dome ready to pull us up. While he was at work an absurd accident, but which might have proved serious, happened to me. I was standing at the foot of the steep incline already mentioned, but was so immediately under Giraud that I had the benefit of his shower of ice-chips. I, therefore, moved my position, and, in doing so, somehow managed to slip, and commenced sliding straight in the direction of a large crevasse. Fortunately a deep step we had cut was within reach of one arm;— I caught at it, and brought myself to anchor, but remained at full length on the slope without the power of getting on my feet. I held on for a few seconds, when Reynaud threw me the end of the rope and pulled me up.

When we were at length across, old Sémond, of course, came after us. We zigzagged up some snow-slopes, and then commenced the interminable array of buttresses which are the great peculiarity of the Pelvoux. They were in many parts very steep, but, on the whole, afforded good hold, and no climbing should be called difficult that does that. The outline on page 249 will give a better idea of them than any description. They abounded in gullies, sometimes of great length and depth— 70° was no uncommon inclination. They were frequently very rotten, and would have been difficult for a single man to pass— with two they are sufficiently awkward: if you are top man, you find yourself being continually abused by the man beneath for the half-hundredweights of stones you send down on his head; and if you are the lower man, you find that there are pleasanter things in the world than being harpooned by your friend's bâton, or having his heavy-nailed boots leave their impression on your fingers.

But, after all, climbing without these incidents would be very slow—they help to break the monotony.

We went up chimneys and gullies by the hour together, and always seemed to be coming to something, although we never got to it. If the reader will look at the outline sketch, he will understand our position. We stand at the foot of a great buttress, about 200 feet high, and look up. It does not go to a point as in the diagram, because we cannot see the top, although we feel convinced that, behind the edge of the fringe of pinnacles we do see, there is a top, and that that is the edge of the plateau we so much desire to attain. Up we mount and reach the pinnacles, but lo! another set is seen, and another, and yet more, till at last we reach the top to find that it is only a buttress, and that we have to descend forty or fifty feet before we can commence to mount again. When this operation had been performed a few dozen times, it began to be wearisome, especially as we were thoroughly in the dark as to our whereabouts. Sémiond, however, encouraged us, said he knew we were on the right route, and away we went once more.

The unavoidable risk we ran from falling stones when we followed each other, had now driven us to act in the most independent manner—each selected the route which was in his eyes the best; so, by-and-by, I found myself alone with Giraud, having completely lost sight of the others. A shout from above presently announced they had met an obstacle; a bit of cliff went straight up which could not be climbed, and it seemed necessary to descend 200 feet to get on to another arête. In a few minutes we came to it, a perpendicular wall of no great height, but quite impracticable. A small cascade came bounding over the top from the end of a long couloir, and had worn itself a route down the face. Giraud was for descending to join

the others who had gone away to the right ; but I did not like the loss of time, so stopped to consider. On the cliff there was not hold for a cat, but up the cascade there seemed a chance. By getting on that knob I calculated that a long stretch would bring that ledge just within reach ; then, by leaning across on my bâton, I should just get to that bit in the middle. "Giraud," said I, breaking off in my calculation, "suppose we go up the cascade." He looked at me with a comical air, to see if I was joking, then at the cascade, then back at me, saying, "*Il n'est pas possible, Monsieur Edward.*" "Giraud, my boy, if I go up, will you follow?" He scratched his head, gave one more look, and stared vacantly into the sky. "Jean Casimir Giraud, will you come up after me?" "Y — e — s." So I buttoned my jacket, turned up the collar, looked to my knapsack, commenced the climbing, and succeeded in getting up. Giraud hesitated, and looked up with an expression of blank astonishment ; but he kept his word and joined me on the top. This manœuvre was of double service ; we saved half an hour, and had all the advantages of a shower-bath without the trouble of stopping.

It was now nearly midday, and we seemed no nearer the summit of the Pelvoux than when we started. The buttresses commenced again, and the gullies were varied by steep couloirs of hard snow. At last we all joined together and held a council. "Sémiond, my antique friend, do you know where we are now?" "Oh, yes, perfectly, to a yard and a half." "Well, then, how much are we below this plateau?" He affirmed we were not half an hour from the edge of the snow. "Very good ; let us proceed." Half an hour passed, and then another, but we were still in the same state—pinnacles, buttresses, and couloirs in profusion, but no plateau. So I called him again, for I had

noticed he had been staring about latterly as if in doubt. I repeated the question, "How far below are we now?" Well, he thought it might be half an hour more. "But you said that just now; are you sure we are going right?" "Yes; he believed we were." Believed! that wouldn't do. "Are you sure we are going right for the Pic des Arcines?" "Pic des Arcines!" he ejaculated in astonishment, as if he had heard the word for the first time, "Pic des Arcines; no! but for the pyramide, the celebrated pyramide he had helped the great Capitaine Durand, &c."

Here was a fix, — we had been talking about it to him for a whole day, and now he coolly confessed he knew nothing about it. I turned to Reynaud, who seemed thunderstruck. "What did he suggest?" He shrugged his shoulders. "Well," said I, after explaining my mind to Sémiond, pretty freely, "the sooner we turn back the better, for I have no wish to see your pyramide."

We halted for an hour, enjoyed the prospect as well as we were able, and then commenced the descent. I know it took us nearly seven hours to come down to our rock; but I paid no heed to the distance, and do not remember anything about it. When we got down, we made a discovery — a blue silk veil lay by our fireside. As these articles are not indigenous, there was to my mind but one solution — Macdonald had arrived; but where was he, and why had he gone? We soon packed our baggage, and tramped in the dusk through the stony desert to Alefred, where we arrived about half-past nine. "Where is the Englishman?" was my first question. He was gone to sleep at La Ville. "What was he like?" — I found that I was not mistaken.

We passed that night in a hay-loft, and slept soundly in spite of our woes; and in the morning, after settling with Sémiond, who professed himself *très content*, I posted

down in advance of the others to catch Macdonald. I had already determined on my plan of operation, which was to get him to join me, return, and be independent of all guides, simply taking the best man I could get as a porter. I set my heart on Giraud, for he was a right good fellow, with no pretence, although in every respect up to the work; but I was disappointed—he was obliged to go to Briançon.

My walk soon became exciting. No end of peasants inquired the result of our expedition, and common civility obliged me to stop. But I was afraid of losing my man, for I had been told he would wait only till 10 o'clock, and that time was close at hand. At last I dashed over the bridge,—time from Alefred an hour and a quarter,—but a cantonnier stopped me, saying that *Monsieur l'Anglais* had just started for La Bessée. I rushed after him, turned angle after angle of the road, but could not see him; at last, as I came round a corner, he was also just turning another, going very fast. I shouted with the voice I learnt in Switzerland, and, luckily, he heard me. We returned, re-provisioned ourselves at La Ville, and the same evening saw us passing our first rock *en route* for another. Our party consisted of Reynaud, Sémiond, an apprentice of Giraud's, and our two selves. I have said we determined to take no guide, but on passing La Pisse old Sémiond turned out and offered his services. He went well in spite of his years and disregard of truth. "Why not take him?" said Macdonald. So we offered him a fifth of his previous pay, and in a few seconds he closed with the offer, but this time came in an inferior position: we were to lead, he to follow.

Our second follower was a remarkable youth of twenty-seven years. Want of space forbids any detailed account of his pranks; how he drank Reynaud's wine, smoked our

cigars, and quietly secreted the provisions when we were nearly starving. For coolness he beat any person I have met. Discovery of his proceedings did not at all flurry him, and he finished up by getting several items on his own account added to our bill, which, not a little to his disgust, we disallowed.

This night we fixed our camp high above the tree line*, and indulged ourselves in the healthy employment of carrying all our fuel up to it. The present rock was not so comfortable as the first, and before we could settle, we were obliged to turn out a large mass which was in our way. It was very obstinate, but moved at length; slowly and gently at first, but faster and faster it went, at last taking great bounds in the air, striking a stream of fire at every touch, which shone brightly out as it entered the gloomy valley below, and long after it was out of sight, we heard it jumping downwards and then settle with a subdued crash on the glacier beneath. As we turned back from this curious sight, Reynaud asked if we had ever seen a torrent on fire. I thought he was joking, but he was in sober earnest. "Every spring," said he, "when the snows begin to melt, many rocks are brought down by the streams, and this is particularly the case in that most turbulent of French rivers, the Durance. At the point where it comes through that narrow gorge at La Bessée, I have seen it frequently so choked with boulders, that no water whatever could be seen, but only rocks rolling over and over, grinding each other into powder, and being dashed into fragments, while the sparks and flashes which they emitted gave it quite the appearance of being on fire."

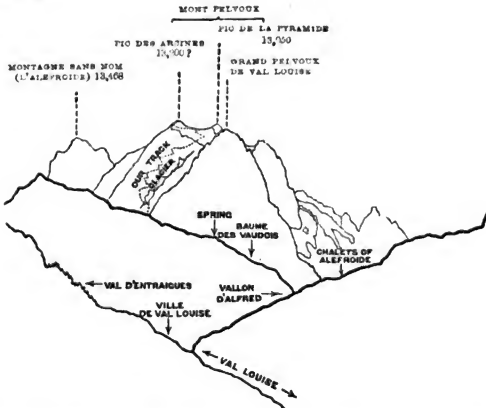
We had another merry evening with nothing to mar it.

* Our rock is marked E on the map.

The weather was perfection, and all Alpine men will imagine, better than I can describe, the treat we had at sunset and sunrise. Macdonald related his experiences over the *café noir*. "I arrived," he said, "at La Ville, shortly after you had left, and, hastening up to La Pisse, learnt that you were going to sleep in a cavern on the mountain side. The thoughts of losing even a chance of an ascent were maddening, so I procured a man to carry my luggage, and started up the valley. I was in bad training, and as tired and sleepy as nothing but thirty consecutive hours in a diligence can make one, so I was not sorry we were obliged to slacken our pace in consequence of the roughness of the ground. We stumbled wearily upwards, till at nine o'clock my guide announced that he thought we were near our destination, but being pitch-dark he would not proceed, as he knew not whether we were above or below the cavern. I was much too tired to dispute his resolution; we therefore chose a big rock as a resting-place, crawled under its lee, and divided our provisions. I soon fell asleep, but rose at the first sign of daybreak. The guide stood at my side, and pointed out the cavern for which we had searched, not twenty yards below; but of course nobody had slept there, and he confessed he knew nothing about you. I asked him if there were no other in which you might have slept. Yes, there was one *tout là bas* and close to the glacier; so off we went on the chance of finding you. But long before we got to it, I discerned your party making its way along a rocky arête 2000 feet above us, and at a great distance. It was perfectly useless to try to overtake you, so I lay down and watched you with a heavy heart until you turned the corner of a buttress and vanished out of sight."

We lay backwards in luxurious repose, looking at the spangled sky with its ten thousand brilliant lights, smoking

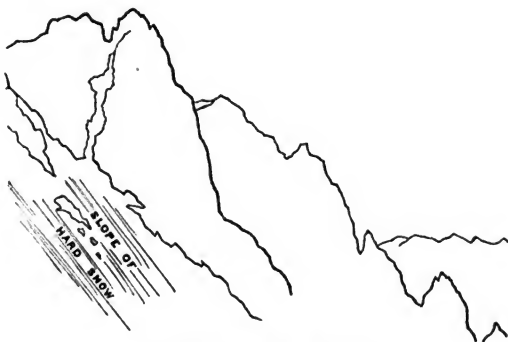
our pipes, and talking over the prospects of the coming day. Nought broke the solemn stillness of the night but the heavy breathing of our already sound asleep comrades. Nothing: it was a silence to be felt. We were alone. Alone? Hark, what is that dull booming sound above us? Is that nothing? There it is again, plainer — on it comes, nearer, clearer — what a fearful crash! — 'tis a crag escaped from the heights above. We jump to our feet. Down it comes with awful fury; what power can withstand its violence? Dancing, leaping, flying, dashing against others, roaring as it descends. Ah, it has passed! No; there it is again, and we hold our breath as, with resistless power and explosions like artillery, it darts past, with an avalanche of shattered fragments trailing in its rear! 'Tis gone, and we breathe more freely as we hear the finale on the glacier below. It was an awful moment, and we felt it.



We retired at last, but I was too excited to sleep, and at a quarter past 4 every man once more shouldered his

pack and started up. This time we agreed to keep more to the right, and see if it were not possible to get to the plateau without losing any time by crossing the glacier. To describe our route would be to repeat what has been said before. We mounted steadily upwards for an hour and a half, sometimes walking, but more frequently climbing, when we found, after all, that it was necessary to cross the glacier. The part on which we struck came down a very steep slope and was much crevassed. But the word crevassed hardly expresses the writhed and twisted look it presented; it was a mass of séracs of most formidable appearance. We found, however, more difficulty in getting on than across it; but, thanks to the rope, we passed it somehow, and the interminable buttresses began again. Hour after hour we pounded upwards, frequently at fault and obliged to descend, but the progress was sure and steady. The ridge behind us had long ago sunk, and we looked over it, and all others, till our eyes rested nearly forty miles away on the majestic Viso. Hour after hour passed, and monotony was the order of the day: when 12 o'clock came we lunched, and contemplated the scene with satisfaction; all the summits in sight, with the single exception of the Viso, had given in, and we looked over an immense expanse—a perfect sea of peaks and snow-fields. Still the pinnacles rose above us, and opinions were freely uttered that we should see no summit of Pelvoux that day. Old Sémiot had become a perfect bore to all; whenever one rested for a moment to look about, he would say with a complacent chuckle, "*N'ayez pas peur, suivez-moi.*" We came at last to a very bad piece, rotten and steep, and no hold. Here Reynaud and Macdonald confessed themselves tired, and talked of going to sleep. A way was discovered out of the difficulty, and I took the opportunity to make an outline of a neighbouring buttress, while sitting

on the top of another. While so employed, some one called out, "Look at the Viso," and we saw that we almost looked over it. We worked away with redoubled energy, hauling one, shoving another, till at length we caught sight of the head of the glacier as it streamed out of the plateau. This gave us fresh hopes; we were not deceived; and with a simultaneous shout we greeted the appearance of our long-



A BUTTRESS OF MONT PELVOUX.

wished-for snows. A large bergschrund separated us from them; but a bridge was found. We tied ourselves in line and moved safely over it. Directly we got across to the top of the snow, there rose before us a fine snow-capped peak. Old Sémiond cried: "The pyramide! I see the pyramide!" "Where, Sémiond, where?" "There, Monsieur, on the top of that peak."

And there, sure enough, was the very cairn he had helped to erect thirty years before. But where was the Pic des Arcines we were to see? — it was nowhere visible, but only an immense expanse of snow bordered by three lower peaks. Somewhat sadly we moved towards the pyra-

mid, sighing that there was no other to conquer, but hardly had we gone two hundred paces, before there rose a superb white cone on the left, which had been hidden before by a slope of snow. At the same moment Macdonald and I shouted, "The Pic des Arcines!" and inquired in a breath of Sémiond, if he knew whether that peak had been ascended by any one. As for him he knew nothing, except that the peak before us was called the pyramid, from the cairn he had, &c. &c.; and that it had not been ascended since. "All right, then, face about;" and we immediately turned at right angles for the cone, the porter making faint struggles for his beloved pyramide. Our progress was in the sixth of a mile stopped by the edge of the ridge connecting the two peaks, and being in the centre of a curve we perceived that it curled over in a lovely volute, on which we were now standing. We involuntarily retreated. The porter, who was last in the line, took the opportunity to untie himself, and refused to come on; said we were running dangerous risks; and talked vaguely of crevasses. Such childish folly we opposed, tied him up again, and proceeded. The snow was very soft; we were always knee-deep, and as with my knapsack I was the heaviest, I was frequently floundering helplessly up to my middle; but a simultaneous jerk before and behind always released me. By this time we had arrived at the foot of the final peak. The left-hand arête seemed easier than that on which we stood, so we curved round to get there. Some rocks peeped out 150 feet below the summit, and up these we crawled, leaving our porter behind, as he said he was afraid. I could not resist the temptation, as we went off, to turn and beckon him onwards, saying, "*N'ayez pas peur, suivez-moi*;" but he did not answer to the appeal, and never went to the top. The rocks led to a short arête of ice — our plateau on one side and a precipice nearly vertical

on the other. We cut up the arête, and at a quarter to 2, three happy individuals stood shaking hands on the loftiest summit of the conquered Pelvoux — the true Pic des Arcines.

The day still continued everything that could be desired, and far and near countless peaks burst into sight without a cloud to hide them. The mighty Mont Blanc, full seventy miles away, first caught our eyes, and then, still farther off, the Monte Rosa group, while, rolling away to the east, one unknown range after another succeeded in unveiled splendour, fainter and fainter in tone, but still perfectly defined, till at last the eye was unable to distinguish sky from mountain, and they died away in the far-off horizon. Monte Viso rose grandly up, but it was only forty miles away, and we looked clean over it to a hazy mass we knew must be the plains of Piedmont. Southwards a blue mist seemed to indicate the existence of the distant Mediterranean; to the west we looked over to the mountains of Auvergne. Such was the panorama, a view extending in nearly every direction for more than one hundred miles. It was with some difficulty we wrenched our eyes from the more distant objects to contemplate the nearer. Mont Dauphin was very conspicuous; but though I knew its situation I looked a long time for La Bessée. Besides these, not a human habitation can be seen; all is rock, snow, and ice, and large as we knew were the snow-fields of Dauphiné, we were surprised to find they very far surpassed our most ardent imagination. Nearly in a line between us and the Viso, was a splendid group of mountains, of whose existence I was unaware. They are immediately to the south of Chat. Queyras, are not laid down on any map, neither do I think they have been mentioned by any author. They are decidedly loftier than the Viso, and their highest summits (for there are several) pro-

bably attain to nearly 13,000 feet. More south an unknown peak was even higher, while close to us we were astonished to discover that the mountain to which Elie de Beaumont frequently refers seemed even higher than the peak on which we stood. At least this was my opinion, and I formed a minority, as Macdonald thought it not so high, and Reynaud much about the same. As I had not read Elie de Beaumont's book at that time, I deferred to the majority. But after reading it I think it is evident, for two good reasons, that this mountain is that to which the French engineers assigned 4105 mètres:—first, our peak was not nearly so much as 450 feet above that of the pyramid—it might, perhaps, be 150 to 200; secondly, our peak was not at the distance of 3000 mètres from the pyramid, but was probably 800 yards. The great black mountain complied, however, with these conditions, as it was certainly three or four times our distance, and also appeared to me to rise at least 200 feet above us. But, for all this, we unquestionably reached the highest point of Pelvoux, and in saying this we are not at variance with Elie de Beaumont, who, as I have shown, refers to the black mountain as one separate and distinct. The testimony of our eyes was quite sufficient to show this, for, after a few steps had gently curved away, they shot down into a tremendous abyss, of which we could not see the bottom, whose depth we guessed at least 2500 feet. After our eyes left the snow on which we stood, they rested on nothing until this mighty wall-sided mountain was seen rising on the other side, black as night, too steep for snow, with arêtes like knife-edges, and a summit sharp as a needle. We were in complete ignorance of its whereabouts, for none of us had been on the other side; we imagined that La Bérarde was in the abyss at our feet, but it was in reality beyond the mountain.

We left the summit at last, and descended to the rocks and to our porter. I melted some snow, and found that, with the air at $9\cdot75^{\circ}$ Centigrade, it boiled at $87\cdot75^{\circ}$ Cent.; and after we had fed, and smoked our cigars (lighted, be it remarked, from a common match), we found that it was 10 minutes past 3 o'clock, and high time to be off. We dashed, waded, and tumbled through the snow, and in twenty-five minutes began the long descent of the rocks. We had taken eight hours to come up them, but now it was getting on to 4 o'clock, and as it would be dark at 8 o'clock, it was evident that there was no time to be lost, and we pushed on to the utmost. Nothing remarkable occurred going down; we kept rather closer to the glacier, and crossed at the same point as in the morning. Getting *off* it was like getting *on* it, rather awkward. Old Sémioud had got over, so had Reynaud; Macdonald came next, but as he made a long stretch to get on to a higher mass, he slipped, and in a moment would have been in the bowels of a crevasse had he not been tied. Thanks to the rope, he was safely landed.

By the time we had crossed, it was rapidly becoming dark, but I still hoped that we should get to our rock in safety. Macdonald was not so sanguine, and he was right; for at last we found ourselves quite at fault, and wandered helplessly up and down for nearly an hour, while Reynaud and the porter indulged in a little mutual abuse. But the dreary fact was now quite apparent, that, as we could not get down, we must stay where we were.

A more detestable locality for a night out of doors, it is difficult to imagine. There were no large rocks nor shelter of any kind; it was too steep to promenade, and perfectly exposed to the chilling wind which began to rise. Loose rubbly stones covered the ground, and had to be removed before we could sit with any comfort. This was an ad-

vantage, though we hardly thought so at the time, as it gave us some employment, and after an hour's active exercise of that interesting kind, I obtained a small strip of about nine feet long, on which I could walk. Reynaud was at first furious, and soundly abused the porter, whose opinion as to the route had been followed rather than that of our friend, but at last settled down to a deep dramatic despair, and wrung his hands with frantic gesture, as he exclaimed, "*Oh malheur, malheur! Oh misérables!*" We were certainly in a predicament; we were at least 10,500 feet high, and if it commenced to rain or snow, as the gathering clouds and rising wind seemed to threaten, we might be in a sore plight; but fortunately matters did not get so bad as that. We were hungry, having eaten little since 3 A.M., and a torrent we heard close at hand, but could not discover, aggravated our thirst. Sémioud endeavoured to get some water from it; and it will give an idea of the difficulty of moving, when I say, that although he got to it, and it was not a hundred feet off, he was wholly unable to return, and we had to solace him by shouting at intervals through the night.

Thunder commenced to growl and lightning play among the peaks above, and the wind, which had brought the temperature down to nearly 32° Fahrenheit, began to chill us to the bones. We examined our resources. They were six and a half cigars, two boxes of Vesuvians, one third of a pint of brandy-and-water, and half a pint of spirits of wine; rather scant for three fellows who had to get through seven hours before daylight. I lighted my spirit lamp, and mixing the remaining spirits of wine, brandy, and some snow together, heated them by it. It made a strong liquor, but we only wished for more of it. When that was done, Macdonald endeavoured to dry his socks by the lamp, and then the three lay down under my

plaid to pretend to sleep. And it was a pretence! Reynaud's woes were aggravated by toothache; Macdonald somehow managed to close his eyes. After lying still, but badly cramped up, for two hours, I couldn't stand it any longer, and promenaded my limited platform for the rest of the night, varying my walk by dancing, like a bear on hot plates, to keep my feet alive, and smoked the cigars the others would not touch. Never before, nor since, have I found a weed so grateful.

The longest night must end, and ours did at last. Sémioud came and shook us up at early dawn. I believe I was getting very fast into a state of torpor, walking up and down mechanically, without the slightest notion of what was going on; the others were dozing. We got down to our rock in an hour and a quarter, and found the lad not a little surprised at our absence, though he had by no means broken his heart over us. He said he had made a gigantic fire to light us down, and shouted with all his might; we neither saw one nor heard the other. I am told we looked a ghastly crew, and no wonder; it was our fourth night out.

We feasted at our cave, and performed some very necessary ablutions. The exceedingly neat and cleanly persons of the natives are infested by certain agile creatures whose rapidity of motion is only equalled by their numbers and voracity. It is positively dangerous to approach too near them, and one has to study the wind, so as to get on their weather side. In spite of all precautions, my unfortunate companion and myself were being rapidly devoured alive, and it was to save the remainder of our wretched carcasses that we performed as above; not that we expected more than a temporary lull in our tortures. The interiors of the inns are like the exterior of the natives, swarming with this section of animated creation. It is said that once, when these tormentors were filled with a

unanimous desire, an unsuspecting traveller was dragged bodily from his bed! This needs confirmation. One word more, and I have done with this vile subject. We returned from our ablutions, and found the Frenchmen engaged in conversation. "Ah!" said a certain aged individual, "as to fleas, I don't pretend to be different to any one else — *I have them.*" This will give the reader a notion of what he may expect in Dauphiné. I verily believe he spoke the truth.

We got down to La Ville in good time, and luxuriated there for several days; but at last it was necessary to part, and I walked southwards to the Viso, while Macdonald went to Briançon.

It will be seen that the ascent of Mont Pelvoux is of a rather monotonous character. From the point where we crossed the narrow glacier to the time we stepped on the plateau of snow, it was one long stretch of more than six hours' continuous climbing, without any break whatever. We came down very fast, and did not rest for a minute; and yet that piece took us four hours.

To those who ascend mountains for views I confidently recommend the Mont Pelvoux; a glance at the map will show that, with the single exception of the Viso, whose position is unrivalled, it is better situated than any other mountain of considerable height for viewing the whole chain of the Alps. Our view included the whole, and extended from the Graians to the Tyrol.

But there is, apart from this, a hearty satisfaction to be felt in making an ascent, which is payment enough in itself. "What is the use of going up mountains?" is a question which is often put. To such I would say: go up a good-sized mountain, and you will know; and perchance it may be, that it will cause you, as it does me now, to look back with pleasure on the past, and forward with hope to the future.

CHAPTER XI.

THE GRAIAN ALPS.

1. THE HUNTING-GROUNDS OF VICTOR EMMANUEL.
2. A NIGHT BIVOUAC ON THE GRIVOLA.
3. THE ASCENT OF THE GRIVOLA.
4. THE ALPS OF THE TARENDAISE.
5. TWO ASCENTS OF THE GRAND PARADIS.

1. THE HUNTING-GROUNDS OF VICTOR EMMANUEL.

BY F. F. TUCKETT, F.R.G.S.

IT had been wild weather amongst the mountains around Zermatt, snow lay far down amid the pines clothing the lower slopes of the Riffel, and M. Bétemps of the *Bureau Topographique* and I, the sole occupants of the Hotel du Mont Cervin, were glad to draw our chairs to the fire as we chatted after our Sunday's dinner. "*Monsieur, il faut attendre jusqu'à ce que la neige ait eu le temps de s'endurcir,*" was Victor's invariable answer to all suggestions of mountaineering, and a recent experience on Monte Rosa of seven hours' uphill wallowing in snow, as incoherent as flour, only too completely justified the dictum. Inaction became, however, oppressive, and the morning of the 27th June, 1859, proving unexpectedly fine, a move over the St. Théodule to Aosta, including an attack *en passant* on the Breithorn, was at once decided on.

The little hut on the col was half full of snow and ice, and of course as yet unoccupied; but the air was still and the weather beautiful, and the joint efforts of Victor, Peter Taugwalder, and myself, soon sufficed to put it in tenantable repair. The hours flew rapidly by, and of all my Alpine recollections few are pleasanter than that of the day of quiet enjoyment spent in this lofty eyrie.

We were astir soon after one the next morning,

quitted the hut at 2 A.M., and at 4.45 stood on the summit of the Breithorn.

Victor had previously ascended this mountain with Mr. E. Bradshaw Smith; but I believe that none of the Zermatt guides had done so previous to my expedition. The credit of having effected the *first* ascent on record is, however, due to our distinguished countryman, Sir John Herschel, who has informed me that he gained the summit by way of the St. Théodule in 1821. De Saussure only reached the lower and nearer summit of the Petit Mont Cervin, which he calls the "*Cime brune du Breithorn*." A gorgeous sunrise was flooding the sea of peaks around with purple light, and throwing the mountain's huge shadow right across the Val d'Aoste, and away past the Rutor to the Little St. Bernard. The colouring was indeed too gorgeous to bode well for the prospects of the day, and after a stay of half an hour we descended to the hut, bade Peter good-bye, and proceeded southwards towards Breuil. A white, angry-looking mist was already driving up the valley, and the wind in fitful gusts moaned dismally as we reached the shelter of the little inn. We had not long been housed, when drenching rain, and the growls of the thunder amongst the cliffs of the Matterhorn, made me congratulate myself that so comfortable a homestead had replaced the wretched huts which were the only refuge on my first visit in 1855, and the miseries of which have been so vividly described by Brockedon.

The morning of the 29th was hopelessly wet, the weather was evidently quite "*gâté*," and waiting would be useless; so, bidding adieu to two unlucky countrymen, who had arrived late the previous night and were bent on reaching Zermatt, we faced the storm and started for Aosta, arriving towards afternoon in a very drenched condition.

Thursday, the 30th, was devoted to pleasant calls on the chanoine Carrel and other friends.

I had long wished to make the acquaintance of this gentleman, distinguished alike for his scientific attainments, his courtesy to all who seek his society or advice, and the fine enthusiasm for his beloved Alps, which renders him so congenial a companion to younger mountaineers. This is not the place to dilate upon individual character, but I cannot forbear expressing my grateful sense of the many kindnesses received both then and since at his hands.

To know M. Carrel, and not to ascend the Becca di Nona, his own particular pet, would be a contradiction in terms too absurd to be thought of; and carried away by his ardour, as well as by the intrinsic fascination of a climb, I at once decided to modify my proposed route, ascend the Becca on the morrow, and, retracing my steps as far as the Alp of Combôè, proceed thence over the Col d'Arbole to Cogne. On mentioning my intentions to Jean Tairraz, the landlord, he gladly consented to accompany Victor and me for a week's ramble amongst the eastern Graians, as the season had scarcely commenced, and his presence as *maître d'hôtel* was not required.

The Graian Alps are confined within the following limits:— On the north and east their boundary is defined by the entire course of the Val d'Aoste, from the Col de la Seigne at its head to Ivrea, where the mountains gradually subside into the great plain of the Po. A slightly undulating line drawn nearly due west from Ivrea to Cuorgne, twenty miles north of Turin, thence up the Val di Locana to Ceresole, at the northern foot of the Levanna, across the ridge to the south of the Col de Galèse, and so down the valley of the Arc as far as St. Jean de Maurienne, would mark out the

southern boundary. And lastly, the course of the Arc to its junction with the Isère, and that of the latter river from this point to its northern source, at the foot of the Col de la Seigne, indicate pretty accurately its western limits. The *massif* of mountains, whose position I have thus endeavoured to define, falls naturally into three subordinate groups.

1. The Central Graians, between the upper Val d'Aoste and the Val de Tignes, extending from the Col de la Seigne to the Col de Galèse, or north-west foot of the Levanna; thus forming a portion of the main chain of Alps which divides France from Italy.

2. The Tarentaise or Western Graians, between the Isère, the Arc, and the Val de Tignes, which are entirely French.

3. The Aostan or Eastern Graians, or Montagnes de Cogne, between Val d'Aoste and Val d'Orca or di Locana, and eastward of the Val Savaranche, which are entirely Italian.

The third and most easterly subdivision groups itself round a central mass, of which the Grand Paradis (13,300 feet) and the Grivola (13,005 feet) are the culminating points, and is intersected by valleys running generally in a northerly and southerly direction. Beginning from the west, we have first the Val Savaranche, connected at its head by the pass of the Nivolet with the Val di Locana, and bounded on the east by the lofty summits of the Grivola, Becca di Montandeni, and Grand Paradis. Next comes the Val de Cogne, debouching like the Vals de Rhêmes and Savaranche at Villeneuve, running at first south towards the Grivola, then sweeping round to the east of that mountain, and south of Mont Emilius and the Becca di Nona, and connected at its head with the lower part of the Aosta Valley by the Col de la

Fenêtre de Cogne, and Val de Champorcher, and southwards with that of Locana by two or three passes and the Val Soana. My explorations in 1859 were confined to the Becca di Nona, the Col d'Arbole, the Val de Cogne, Col de l'Arietta, Val Soana, Val Locana or d'Orca, Col de la Croix de Nivolet, the Val Savaranche, the Grivola, and the col of the same name.

The *droits de chasse* of the entire district have been acquired by the king either by purchase or parliamentary grant. In each valley, posts are set up with the inscription, "*défense de chasse*," and two *gardes-chasse*, or keepers, are stationed at each of the *chefs-lieux* of Cogne, Campiglia, Ceresole, and Valsavaranche, under the command of a corporal at the first-named place, in order to enforce strict preservation of the game. The special interest attaching to this region, in the eyes of a sportsman and naturalist, is that the noble Steinbock or Bouquetin (*Capra Ibex*), which has been gradually extirpated in almost every other of its European habitats, is still to be met with here. During the week spent in beating up their haunts it was not my good fortune to see one, but in the summer of 1861, in the course of an ascent of the Grand Paradis, I was more successful, as we came suddenly upon one which had ventured down upon the moraine of the Glacier de Montcorvé, and did not perceive us till we were within twenty or thirty feet of him.

At the time of my visit, the only information accessible to me on the subject of what was commonly called "the Cogne country" was contained in the works of Mr. King and Mrs. Cole, the notes of M. Carrel to his "*Alpes Pennines vus dans un jour*," Murray's Handbook for Switzerland and Savoy, and a casual notice in Professor Forbes' "Travels in the Alps." More recently another lady writer, Mrs. Freshfield, has touched on the district in question in

"Alpine Byways," one of the pleasantest records of Alpine travel that has yet appeared, whilst an interesting paper on its western portion was contributed by Mr. Cowell to the first series of "Vacation Tourists," and each year is adding to the number of explorers in search of unhackneyed routes and fresh sensations.

I was up at 2 A.M. on Friday, the 1st of July, and after despatching as hearty a breakfast as was compatible with a somewhat recent supper, started at 3.30 for the Becca di Nona. The morning was cool and cloudless, a star or two twinkled in the sky, but dawn was advancing with rapid strides, and already the snowy mass of the Ruitor at the head of the valley had caught the pale yellow light, and stood out in high relief against the dull grey background of sky. As the blush spread to lower summits, and gradually kindled the valley into life, the song of nightingales burst forth in responsive harmony, and the verdure of the dew-bespangled meadows and vineyards completed a picture of peaceful beauty, such as Milton might have conceived when he sang—

"Sweet is the breath of Morn; her rising sweet,
With charm of earliest birds; pleasant the sun,
When first on this delightful land he spreads
His orient beams on herb, tree, fruit, and flower,
Glistening with dew; fragrant the fertile earth
After soft showers." . . .

Casting many a backward glance at the sleeping city, Victor, Jean, and I wound leisurely up the path to the village of Charvensod. Passing this, we left to our right the usual mule-track which leads to Combôe *viâ* the Hermitage of St. Grat, Chamolé, and the Col de Fenêtre, and made straight for Les Pouces at the north-east foot of the Signal Sismonda. At every step the view behind grew more lovely and extensive, the mountain summits glittered

in the morning light, and soon after 5, just as Monte Rosa peered above the nearer ranges of the Vals d'Ayas and de Lys, we emerged into brilliant sunshine. The temptation to make frequent halts, in order more thoroughly to drink in all the beauties of the scene, was irresistible, however much to be combated.

Our path now turned eastwards round a spur of the Signal, which here cuts off the view of the upper portion of the Val d'Aoste and of the city itself, but in exchange a scene of surpassing loveliness now opens out in the opposite direction. At the head of a valley, along whose western side the track passes, the beautiful cascade of the Dard leaps into a little amphitheatre of green, in exquisite contrast with the frowning crags of the Becca di Nona, which rises in rugged grandeur on the opposite side, whilst, turning to the north-east, the picture is completed by the noble form of the Matterhorn. Following a water-course, fed by the stream of the Dard, we crossed to the right bank, and striking up through little islets of verdure and beds of rhododendrons, reached the cascade at 6.55 A.M., from which spot the Grand Combin, or Graffeneire, is a conspicuous object. A zigzag path leads up the slopes to the east of the fall, and so past the Châlet de Pontaille, and over a grassy ridge or col to the Alp of Combôé. This group of châteaux, charmingly situated in an upland valley, belongs to the Chapter of Aosta; and, not content with constructing a path from them to the summit of the Becca, M. Carrel has recently erected a little mountain inn, where provisions will be kept during the summer, and three or four beds may be obtained by those who wish to gain the summit of the mountain at an early hour.

A description of the ascent of the Becca di Nona would be superfluous after the detailed account in M. Carrel's '*Alpes Pennines*,' and the pleasant pages which the

authoress of "Alpine Byways" devotes to this excursion. At every turn of the path fresh points of interest are disclosed. First Mont Blanc and his aiguilles rise majestically above the ridge to the south of the Signal Sismonda; farther to the left the Grivola, Grand Paradis, and Mont Emilius, rear their heads in succession above the nearer range; and finally, on gaining the summit, the entire chain of the Pennine Alps is disclosed to view. The one great drawback to this panorama is the break to the east and south, caused by the mass of Mont Emilius and the series of summits between it and the Grand Paradis, which effectually cut off all view of the lowlands. The union of mountain and plain, each giving the added charm of contrast to the other, is thus lost, and the scene assumes a character of sternness, which is only partially dispelled by the peep into the smiling Val d'Aoste, nearly 9000 feet below, or the nearer verdure of Combôè.

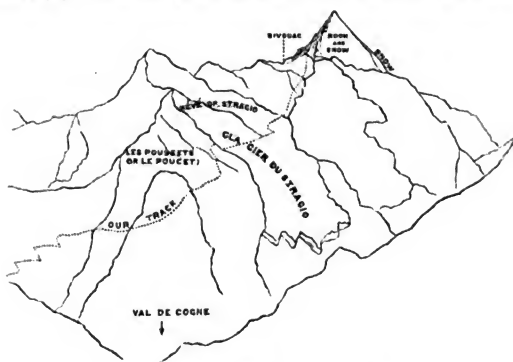
Our halts had been so numerous, that it was 11 A.M. before we reached the summit. Two hours were spent here in the greatest enjoyment; but at length, having secured a barometric observation, which gives a height of 10,403 feet (10,384 according to Carrel), we began to think of resuming our progress. Before, however, quitting the subject of the Becca, I may just mention that an Alpine Club minimum thermometer, No. 306, was placed in the cairn on the summit by Mr. Malkin in July 1860, and carefully examined on the 27th June, 1861, by M. Carrel. He informs me that it registered a minimum temperature of -27° Centigrade (or -16.6° Fahr.), a result of some interest, as at the time this was probably the first record of the lowest winter temperature of so elevated an European station.

Our object being to reach Cogne, instead of returning to Combôè, we merely descended as far as the point named the

Gros Cez, and then quitting the path, struck off to the left, for the ridge which shuts in the Combôé Alp on the south-east, and forms the north-west limit of the higher pastures of Arbole. These were reached at 2.30 P.M., after a roughish scramble; and a question now arose as to the direction to be followed. We had no map with us, and this was a *terra incognita* to my companions as well as myself. We were still far from our destination, the afternoon was going apace, and it was not desirable to follow a wrong lead. The valley sweeps round to the left, running up in an easterly direction towards Mont Emilius; and the point to be decided was, whether we should follow it to its head, and then strike across the ridge to the south, or attempt the passage by a promising-looking gap more directly in front, and nearly due south of our actual position. An inspection of the compass settled the point in favour of the latter course, and the event proved that we were right.

Traversing heaps of rocky *débris*, and passing two small lakes close together, we found ourselves at 3.45 P.M. at the base of the snow-slopes leading to the supposed col. Whilst ascending these, we were much interested and amused by the gambols of three chamois,—one of them a noble *bouc*,—who perched themselves on a precipitous and splintered crag to the west of the gap, and performed a series of acrobatic tricks of the most surprising nature, till, frightened at our approach, they disappeared behind the ridge. At 4.25 P.M. the summit of the Col d'Arbole was reached, and a view of unexpected sublimity burst upon us. Immediately beneath, slopes of *débris* led down to an upland pasture, and beyond lay the great chasm of the Cogne valley, backed by the noble forms of the Grivola and Grand Paradis. After securing a hasty sketch, and a barometer observation, which gives a height of 9160 feet (Favre makes it 9341), we pushed on down the "*clappey*"

as rapidly as its extreme ruggedness would permit, and traversing a beautiful alp, reached the Croix d'Arpisson and the adjoining châteaux. Their situation is exquisite. Standing on the brow of an extremely precipitous descent, the little village of Epinel, in the Val de Cogne, is seen at a vast depth, surrounded by rich meadows and much ploughed land; whilst immediately in front the mass of the Grivola towers up majestically, presenting an appearance which in beauty and grandeur reminded me strongly of the Jungfrau as seen from Mürren, and com-



THE GRIVOLA FROM COL D'ARPISSON.

paring by no means disadvantageously with the Queen of the Oberland. A little further on we came to the pine-woods, and zigzagging down by a steep but well-made path, disclosing at every turn lovely peeps through the vistas of larches, the sound of cow-bells suddenly fell upon our ear. Jean, with a mischievous look, now suggested, that as travellers were almost unknown in these parts, we might, especially by putting on our linen masks, create quite a sensation. Victor, more cautious, hinted that the natives might be frightened into fits; but Jean was determined to

have his joke, so the hideous disguise was donned, and we soon found ourselves confronting an aged crone and her three equally lovely granddaughters, whose wooden expressions were only redeemed from utter commonplace by a superabundance of the most ferocious hair. Alas! for Jean. They were sublimely phlegmatic; not a muscle of their faces moved; they were not even inquisitive, much less terrified; and when Jean demanded milk in a husky voice, and requested to be informed whether we could sleep on the summit of the Grivola, winding up with a handsome bid for the ugliest daughter, with no more exciting result, the laugh was so clearly against us that the masks were at once laid aside. One of the sisterhood pointed out a path leading to the level of the valley, at a point considerably higher than Epinel, which would enable us to avoid a steep descent as well as save time,—a matter of some importance, as it was already 7 o'clock. A pleasant walk of three-quarters of an hour brought us to the village of Crétaz, and at 8 we reached Cogne.

I had been prepared to expect a savage and narrow valley, and its beauty, extent, and richness quite took me by surprise. Fine broad meadows surround the village, and though the Grivola itself is invisible, the Glaciers of Grancron and Monei, and the chain of the Grand Paradis and Tour de St. Pierre, to the south, form a most noble background; whilst, in the opposite direction, Mont Blanc is visible above the gorge, into which the valley narrows lower down.

I found M. le Curé just outside the little inn or cabaret, and whilst Victor and Jean attended to the commissariat, I discussed with him my proposed attack on the Grivola. Though the weather had now become thoroughly fine, the storms of the previous week had clothed the loftier

peaks with a deep coating of fresh snow, and after some discussion I came to the conclusion that it would be better to devote the next few days to a general exploration of the district, and afterwards attempt the Grivola, rather than proceed at once to the assault, which might be defeated by the danger of dislodging avalanches.

After a supper very decently served, I asked, not without fear and trembling, to see my room, and was conducted out of doors and to the first floor of the singular building, whose upper story was occupied by Dr. Argentier. Though the "*appartement*" could hardly be said to be "*garni*," there was really nothing to complain of but a deficiency of washing appliances.

This curious old tower bears on its front the date 1374. Its construction is usually attributed to certain mediæval worthies, who were known as the Seigneurs de Cogne, and appear to have been stirring people in their day, to judge from a ballad of the Eringerthal, composed in 1475, after the defeat of the Duke of Savoy.*

How they were connected with Chillon is unknown to me, and I gladly leave the question in the hands of the

* Quoted by Fröbel in his "*Reise in die weniger bekannten Thäler auf der Nordseite der Penninischen Alpen*" (Berlin, 1840). It is in the peculiar *patois* of the valley, and I append a translation of the verse referred to:—

‘ Juantin Peter de Rarogne
Ire évêche dedans Chion,
Les verts comtes de Cogne
Vignéent doû Zathé de Zillon,
Po ché faire la guerra
Su le évoé et suc terra.”

“ John Peter of Rarogne
Bishop was at Sion,
When there came green counts of Cogne
From the castle Chillon,
Bringing war and slaughter
On the land and on the water.”

antiquaries ; — content to know that they were at any rate excellent architects, whose handywork has stood the test of five centuries, and still affords substantial shelter.

The mean of two barometric observations gives, by comparison with Aosta, a height of 4998 English feet for the *salle* of the inn at Cogne.

Rising at 5 on the morning of the 2nd, I was delighted to find the weather everything that could be desired. I had determined to cross the Col de l'Arietta to Ponte in the Val di Locana or d'Orca, and as the distance was considerable, had hoped to effect an early start. Jean was already acquainted with the pass, having traversed it many years previously during an expedition in these parts, for the purpose of obtaining live bouquetins for the late Earl Derby; and his description of its beauty not a little influenced my decision. He succeeded in procuring nearly a dozen young ones, and transported them in safety to Chamounix, where, however, they all sickened and died before he could make arrangements for their transmission to England. The preparation of provisions, a call on Dr. Argentier, and other preliminaries, occupied so much time that it was 8 A.M. before we were off. The Doctor most kindly insisted on accompanying me as far as the head of the valley, and as we quitted the village the Curé also joined us. At Lillu, or Lilaz, where there is a magnificent view of Mont Blanc, I bade them good bye, and turning to the left, pushed on up the eastern arm of the valley.

It is not my intention to dwell minutely on the features of this day's work, as a condensed, yet complete and truthful, description of the route will be found in Murray's Handbook; and so I will merely say that our course as far as the châteaux of Chavannes lay in the direction of the Fenêtre de Cogne, which leads to Champorcher, and

thence to the lower part of the Val d'Aoste at Fort Bard. We reached these châteaux about 11 A.M., having walked at a very leisurely pace; and finding that the "Brousse" had just been prepared, we ensconced ourselves in the shade, each with his brimming bowl, and feasted on its contents and the beauty of the view, to which the bold peak of the Grivola gave the principal charm. In this state of lazy enjoyment we contrived to consume an hour, on the principle that, having made a bad start to begin with, it was useless to be in a hurry, and moderate recklessness of consequences was therefore justifiable. A little beyond the châteaux we quitted the path to Champorcher, and striking off to the right, climbed for some distance up a ridge of rock, and then took to a rather steeply inclined and snow-clad glacier descending from the Col de l'Arietta, or della Nuova, as it is sometimes called. There was no sort of difficulty, and at 2 P.M. we stood upon the ridge. During the ascent, as well as from the col itself, Mont Blanc was a grandly conspicuous object, whilst, on gaining the summit, the view to the south was one of extreme beauty and interest. The Val Soana lay spread out like a map at a vast depth beneath, its bounding mountains basking in the soft blue tones of an Italian atmosphere, whilst beyond, the plain of the Po was distinctly visible through the golden haze. It was difficult at first to identify Turin itself, but I soon caught the dome of the church on the Superga, distant forty miles, and, with it for a guide, other familiar objects gradually developed themselves. It is worth while to mount, as I did, a summit to the west of the pass, which, being some hundred feet higher, increases the range of vision, bringing into view portions of the Monte Rosa group, the Grand Combin, Mont Emilius, the Grivola, and the Grand Paradis.

Before quitting the col I set up my barometer and secured an observation, the resultant height of which is 9,435 feet, or 221 feet lower than that stated in Durheim's "Hypsometrie," on the authority of Favre.

It was hard work to quit our station; but we had already spent an hour and a half on the summit, and our hopes of reaching Ponte that night were becoming fainter and fainter. The descent was commenced about 3.30 P.M., and keeping away constantly to the left, or south-east (a clue which it will be well for future comers to bear in mind), we reached the level of the Val Soana at 5.15 P.M. The scenery was exquisitely beautiful, and at the same time full of grandeur. Behind us rose the ridge we had been traversing, which, seen from below, presented a very forbidding and Gemmi-like appearance; and to the west, above a fine amphitheatre or *cul de sac* in which the valley terminates, the noble peaks of the Punta di Lavina towered up from a base of snow and glacier. Coming upon some châteaux, we halted to procure milk, and then pushed rapidly down the valley towards Campiglia, from which this branch of the Val Soana is named. Happening to look round we noticed a *garde-chasse*, armed with a rifle slung over his shoulder, coming along at a great rate, and evidently in pursuit of the three suspicious-looking strangers. Slackening our pace, we allowed him to overtake us, and I was greatly amused at the furtive glances he cast at my innocent barometer, which he had evidently taken for a gun of some new construction. Without saying anything, I soon took an opportunity of removing the leather case and setting up the instrument; the doubt in his mind thus removed, he became very communicative, and volunteered to accompany us as far as Campiglia, his head-quarters. We arrived at this wretched-looking but picturesquely situated spot a little before 7 P.M., the

valley in deep shade, and darkness coming on apace. To make matters worse, the path was one of those excruciating *pavés* in which the natives of the Italian valleys seem to take such delight, but which are instruments of torture to the pedestrian, especially when, with snow-soaked boots, he has to stumble down them after nightfall.

Quitting Campiglia at 7.15 P.M., we passed the entrance to a valley coming in from the north-east, from the head of which three passes lead to Champorcher, traversed the little village of Valprato, and at 8.15 P.M. reached Ronco. By this time it was quite dark at the bottom of the narrow valley; and as Ponte was still three hours' distance, we decided to remain where we were for the night, although an inspection of the inn was terribly confirmatory of the statement in Murray, that "hunger and fatigue alone can make it endurable." Patience and contentment will, however, accomplish even greater wonders; and whilst nothing can honestly be said in praise of either board or lodging, I had no great cause to complain, though an entomological night on crackling maize-stalks in an old lumber-room made me nothing loth to turn out between 3 and 4 the next morning.

After a light breakfast, we started at 4.30 A.M. for Ponte. The air at this early hour was deliciously fresh and invigorating; for a long time the mountains to the east screened us from the sun, and even when it rose above them, the luxuriant chestnut woods through which our path lay, prevented our being unpleasantly affected by the heat. Fresh beauties were disclosed at every turn, and I recollect few walks of equal length combining more varied charms.

Soon after quitting Ronco, the hamlet of Boschi is seen at the entrance of the Val di Forzo, which runs up in a north-west direction, parallel to the Val di Campiglia, and communicates at its head with the Cogne valley, between

Lillu and Chavannes, by the pass of the Col de Bardonney between the Tour du Grand St. Pierre, and the Punta Lavina. This would probably furnish a more direct means of communication between Cogné and Ponte than the Col de l'Arietta. It is one of many passes traversing the ridge north of the Val d'Orca, all of which are probably easy, but as yet almost unknown to our mountaineers. The following are the names of some of them, beginning at the east foot of the Tour du Grand St. Pierre:—Col de Bardonney, Bocchetta di Rancio, Bocchetta della Scaletta, Col de l'Arietta, Boccie della Balma, Col di Larizza, and Col de S. Anna, Champorcher, or Reale.

Ingria is the next village of any size, and here the Val Soana assumes a ravine-like character, which it retains to its termination. Nothing can be more picturesque than the approach to Ponte, which is seen some time before the Val d'Orca is reached, the path descending to the bottom of the valley, and passing through a gorge of singular wildness and beauty, along which the bright and sparkling stream foams and dashes in joyous haste. A little further on the extensive cotton-mill established by the Baron du Port was passed, and we entered the town itself. As we traversed the narrow streets, thronged with crowds of workpeople, citizens, and peasantry, in Sunday costume, we attracted no little attention, and evidently puzzled a group of *gens-d'armes*, who could make nothing of our mountaineering equipment, axes, batons, and barometer.

Not having Murray with me, I enquired the name of the best inn, and was at once conducted to the Valentino, a house of very respectable appearance, which by no means belied its promising exterior. It was only a little after seven, but the weather had now become extremely warm, and even at this early hour the heat was oppressive.

Pushing aside a gay-coloured curtain which did duty for a door, we entered a cool and darkened room or *salle*, from which another door led into a back-court or garden, furnished with a gigantic arbour of trellis-work. After our experience at Ronco, and even Cogne, the change was an agreeable one, and we congratulated ourselves on having met with such excellent quarters for our Sunday's rest.

A nicely prepared *déjeuner à la fourchette* was soon served, and we feasted on fresh trout, cotelettes, fruit, and excellent bread.

As I expected, it was not long before we received a visit from two of the *gens-d'armes*. The rarity of a traveller, and the fact that everyone had been recently on the *qui vive* in consequence of the neighbourhood of the Austrian army of invasion, were quite sufficient to render the appearance of three strangers a suspicious circumstance, in the eyes of at least the minor authorities. A little explanation, however, a few compliments, and a judiciously administered glass of wine, satisfied our visitors that we were neither the Emperor of Austria nor any of his myrmidons, and they politely withdrew.

Taking up one of those wretched little paper plaisters that furnish, or used to furnish, Italians with their political *pabulum*, my eye caught the details of a bulletin announcing the victory of Solferino on the 25th of June, just one week previously ; but, so far as I could judge, the intelligence seemed to excite but little interest, the predominant feeling being that, though it might be all very well to beat the Austrians, there would be a heavy reckoning to pay, both in blood and money. Besides, the mere fact of a victory affected the rural population less tangibly than the absence of their able-bodied men, just as the hay wanted getting in on the upland slopes, and summer, with its varied occupations, was come.

We spent the hottest hours of the day under the pleasant shade of the spacious arbour, but quiet was out of the question, as after 10 A.M. people kept streaming in and seating themselves at tables, with their *cruches* of wine, laughed, gesticulated, and vociferated as only Italians can.

I had noticed that I was the special subject of observation to a group in a neighbouring corner, and presently an old man came forward, and asked me very politely if it were true that I was an Englishman. On receiving an affirmative answer, he expressed much pleasure, and begged to be allowed to fetch his son, who had travelled with a "Signor Inglese" in these parts, and knew "*tutt' il paese com' un libro*." I of course assented, as I was in want of information, and he soon returned with his son, a *chasseur par passion*, and named Matteo Trucano. To my surprise I learned that he had accompanied Mr. Brockedon, of whom he spoke in the warmest terms. Of course, like every foreigner who has had the honour of meeting "*le célèbre M. Jones, Sir Smith, or Brown Squire de Londres*," he imagined that I must be intimate with his former employer, and I fear I fell greatly in his estimation, when forced to confess that, though Mr. Brockedon's name was well-known to me, and a large number of my countrymen, through his pen and pencil, I had never had the pleasure of his personal acquaintance. He was, however, extremely civil; and proved a pleasant companion, giving me much valuable information.

Finding, as usual, that inaction made us only more sensible of the heat, and wishing to see something of the neighbourhood, we ventured forth into the blaze between 3 and 4 P.M., and strolled towards the meadows on the river bank, for the sake of the current of cooler air borne along by the water. Even here the sun beat down upon us unmercifully, and whenever we were tempted to stretch

ourselves on the grass beneath the trees, a fearful plague of flies drove us from our resting-place, and compelled us to seek peace in constant movement. Sauntering up the valley we next mounted a precipitous knoll, commanding a beautiful view, including the tower of an old ruined castle on a twin eminence. The cotton-mill or "*Fabbrica*" is nearer to the entrance of the Val Soana, and gives employment to a large number of hands. A good road, traversed by a diligence in six hours, connects Ponte with Turin viâ Cuorgne.

We found our appetites seriously *démoralisés* by the heat and repose; but, nevertheless, a light Italian dinner, nicely prepared by our active hostess, was not unacceptable about 7 P.M. The evening was lovely, and I sat about in the garden as the gloom deepened, listening to the subdued roar of the torrent and watching the fire-flies as they flashed amongst the vines. If early rising has its advantages and charms, it has also its duties; first amongst which is an early retirement to rest, and though I longed to linger, I betook myself between 9 and 10 to my clean-looking, pleasant chamber, opening into a balcony above the main street, after ordering breakfast to be ready a little before 4 A.M.

I was astir soon after 3 A.M., but on coming down found no one about but Victor and Jean. Our host and his wife were still fast asleep, and it was consequently nearly 5 before we succeeded in procuring anything to eat. The delay was annoying, as we had a hot and shadeless walk before us up the valley to Ceresole, and though the distance was comparatively trifling (six to seven hours), we had hoped, by accomplishing the first part of it before the sun gained much power, to be able to rest during the hottest hours of the day, and proceed leisurely in the cool of the evening. A difficulty in obtaining the bill, followed by a

dispute over some of its items, still further detained us, and it was not till 5.30 A.M. that we effected a start.

Already the power of the sun's rays was making itself felt, and our progress along the broad and well-made, but shadeless and dusty road, was somewhat toilsome. Even as early as 4 A.M. the temperature in the shade had been 73°, and at noon it rose to 93°. Comforting ourselves with the reflection that this state of things would tell with tremendous effect upon the recently fallen snow, and thus clear the way for our meditated assault upon the Grivola, we kept steadily on, and in two hours reached the little town of Locana.

Above this place the valley gradually becomes wilder, and about midway between it and L'Illa, fine, rugged, and serrated peaks rise in front, and the road traverses enormous and picturesquely grouped masses of rock, covered with a fine growth of chestnuts. Here too "*roches moutonnées*," the handywork of ancient glaciers, abound, extending from the level of the valley to a height of 600 or 800 feet on the mountain sides. Passing L'Illa, a little beyond which the road ceases, we soon reached a solitary house, called Val Pra, and seeing something resembling an inn sign, turned aside to seek shelter from the sun, which was getting almost unbearable.

The place was dirty, and its resources limited; but a civil man bade us welcome, and though at first astonished at our preferring the shade of his orchard to the shelter of his den, seemed disposed to do his best to make us comfortable.

At length the heat moderated, and we proceeded on our way at 5 P.M. Noasca, whose wretchedness has provoked the couplet,

"Noasca, Noasca,
Poco pane, lunga tasca,"

was reached in an hour, and just beyond it we came upon one of the finest cascades I ever saw, succeeded by another scarcely inferior. Here, too, the mountains rise proudly, and the main valley bends round to the south-west, whilst at no great distance from one another three small lateral ones run up northwards, towards the Grand Paradis. From their heads, passes lead, I believe, east of the Paradis into the Cogne valley, by the Glacier de Monei, and south of it into the Valsavaranche, by that of Montcorvé. Both of these must offer fine glacier scenery.

Keeping to the Val Locana, and turning to the left, we threaded our way through a complete chaos of rocky fragments, some of them of enormous dimensions, piled on one another in the wildest confusion. Before us, through a sort of rocky col or gap, some fine snowy summits now came into view, which proved to be a portion of the Levanna. Towards this gap, and by the side of the torrent, the path winds upwards, sometimes passing under natural arches formed by the masses of débris and sometimes cut in the live rock. This spot is called the Scala, or Scalare, di Ceresole, and from its summit, which we reached a little after 7 P.M., a magnificent view is obtained of the broad and smiling valley of Ceresole, backed by noble, but unfamiliar, mountain forms. The sudden transition from the gloomy gorge, and the deafening roar of the torrent, which, at a distance of only a few feet, leaps down in a series of rapids, to the lovely and peaceful scene before us, was very striking. By contrast we appeared to emerge into broad daylight, but, in fact, the sunset glow had already faded from the mountain tops, "the shades of night were falling fast," and a young moon hung over the triple head of the Becca a tre Corni, as the Levanna is here called. The character of rugged wildness which had distinguished the valley since we

quitted L'Illa and Val Pra now gave place to softer features; fine pinewoods clothed the mountain sides, and rich meadows gave to the little plain an air of thrift and civilisation.

A still greater surprise awaited me on our arrival at the little inn, twenty minutes below the village of Ceresole, about 7.40 P.M. If the valley had changed for the better, so had the people; and instead of some wretched place which we had been prepared to meet with, we were most agreeably surprised to find a roomy, clean, and comfortable-looking dwelling, with more of the Swiss than the Italian character about it, and all the appliances of a good mountain inn. We learned that the landlord was a brother of him of the Valentino at Ponte; that the house was frequented by Turinese, who came, sometimes to the number of thirty or forty, to enjoy the pure mountain air and drink the waters of a neighbouring mineral spring, and that when the King came hither for the chase he made it his head-quarters. The landlord informed me that he had just received a letter from the King, requesting him to have everything in readiness for the shooting season, as since the victory of Solferino had been won, he hoped to get some sport in August; and, should endeavour to persuade the Emperor to accompany him and try his hand at a Bouquetin. Some papers just received from Turin served to pass away the time, and at 10 P.M. I retired to my comfortable double-bedded chamber, and, in the King's own bed, slept, not as at the lower level of Val Pra,

"Hushed with buzzing night-flies to my slumber;"

but as the Ré galantuomo himself would probably at the moment have gladly been able to do.

On rousing the next morning the same cloudless weather greeted me, and I resolved to devote the day to the

leisurely enjoyment of this charming spot, and *desipere in loco* to my heart's content. A delicious bathe, and a visit to a mineral spring in the vicinity, served to pass away the morning; and I had much pleasant chat with one of the royal "Gardes-chasse" stationed here. He informed me that he and his comrades received fifty francs per month, besides being found in clothes. The penalty for killing a Bouquetin is 600 francs fine, and nine years at the galleys. To this the keepers themselves are liable; but as their office is much coveted for its high pay, and they might be subjected to false accusations with a view to obtaining their situations, it is provided that whilst the testimony of one of them shall be sufficient to criminate others, that of two peasants shall be required to inculcate them. In August, 1861, there appeared in the "Times" a ridiculously exaggerated account of the extraordinary feats of speed and endurance performed by the King during his shooting expeditions; but, after careful enquiries on the spot, I am convinced that, though his majesty is undoubtedly a keen sportsman, and possibly not a bad shot, he would be the first to smile at such absurdities as the following. "The horn is wound, the hunt is up, and away he rides as fast as the nimblest mountain nag can carry him, and then takes to his legs, and *the race is between him and the swiftest quadrupeds*, over crags and along gullies *common men shudder only to look at!* He came back to Turin a few days ago in great glee, telling his friends that he had given chase to a Bouquetin for two whole days, had parted company with his aides-de-camp, his guides, his huntsmen, every man in his suite; he had followed the coy mountain goat, he had pressed closer and closer, he had driven it higher and higher up; *he had knocked it up (!)—blown all the wind out of its panting body (!)*—and had at last brought it back triumphant, the

prize of that untamed strength which has no match in these regions." (!!!) At any rate, in the course of all his *chasses* in this particular district, four Bouquetins only had fallen to his rifle. When shooting, he is, of course, accompanied by a number of chasseurs, who beat the mountains for game. The "Garde-chasse" informed me that the hours at which Bouquetins are most frequently to be seen are before six in the morning and after 4 P.M., as during the heat of the day they retire to the shade of the rocks.

For the information of future travellers, I will here mention that several passes besides the two alluded to, when speaking of Noasca, connect the upper part of the Val di Locana or d' Orca with the neighbouring valleys. To the north, the Col de la Croix de Nivolet, which I proposed to cross on the 6th, leads into the Valsavaranche. In a westerly direction the Col de Galèse and Passo della Vacca communicate with the upper portion of the Val de Tignes, whilst southwards, to the west of the Levanna, the Col del Carro, said to be 10,000 feet in height, connects Ceresole with Bonneval, in the valley of the Arc, and at its eastern foot the Col del Piccola gives ready access to the Val Forno.

Enquiring as to the accessibility of the Levanna from this side, I was referred for information to a man standing close by, one Joseph Aubert by name, but also passing under the soubriquet of "Manchot." He was said to be the best guide in the district, and I suspect he may be the individual referred to in Murray, under the name of Giuseppe Bruscha, surnamed "Muot." Be this as it may, he declared that he had ascended the mountain some years previously with an officer of the État-Major Sarde, or some similar official, and though the direction he pointed out did not appear promising, the idea was so

tempting that I returned to the inn almost resolved to devote the morrow to this expedition. While dinner was preparing, however, I had some further talk with the "Garde-chasse" and one or two men who were lounging about the door, and learned from them that my new acquaintance had never been to the summit of the Levanna at all, but merely happened to be traversing a snow-field about 800 feet below it when the Piedmontese gentleman and another chasseur effected the ascent. Sending for the "real Simon Pure," whose name I found was Giacomo Giannino, he informed me that he had indeed ascended the mountain fifteen or sixteen years before; but as, on being cross-examined, and put to the test, he appeared quite unable to point out the route, and, after a careful examination through the telescope the chances of success in this direction appeared to be very doubtful, I decided on giving up the attempt.

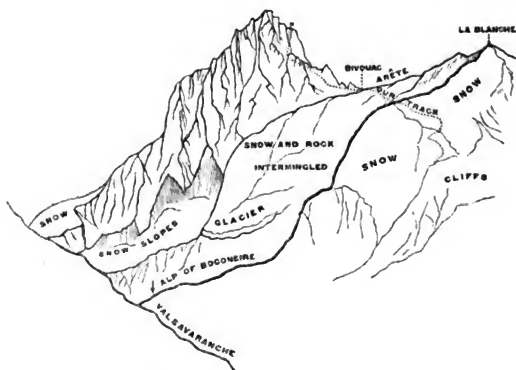
We quitted the inn soon after 2 A.M., on Wednesday the 6th, with a native of Ceresole, one Giacomo Riva, who was about to visit Aosta on business. Hearing of our intention to cross the Nivolet, he volunteered his company, which was at once accepted, as he knew the track well, and, though no difficulties were likely to be encountered, time might be saved by local knowledge. It was still dark as we walked up the valley, and a warm wind blowing up it made us fear a change of weather. After passing Villa, where the syndic Pietro Quindo will, according to our companion, receive travellers and supply wine, it had become quite light, but the portion of the valley we were now traversing is less interesting than the immediate neighbourhood of Ceresole, and there was little inducement to linger. Between four and five the last village, a miserable place, was passed, the Col de Galèse appeared in front, and we descried the lateral valley on our right, up

which lay our course to the Col de la Croix de Nivolet. It seemed to us that it would be perfectly easy to ascend the former pass, and then gain the Nivolet without redescending materially, by following the slopes of the mountain (the Punta di Galisia) which divides them, and that the detour would not occasion a delay of more than two, or possibly three hours. As, however, we were ignorant of the country, we did not like to risk this additional expenditure of time, and therefore kept to our original track.

At 6.30 A.M. we reached a little green plateau, not very far from the summit of the pass, and opposite the grand precipices of the mountain which appears to correspond with the Punta di Galisia of the Sardinian map. In the direction of the Col de Galèse, and at a considerable depth below us, the châteaux of Serue and two wild tarns were seen. The chasseurs had informed us that the great cliffs to the west were a favourite resort of Bouquetins, and we long and anxiously scanned them through my telescope, in the hope of discovering a troop. Not one, however, made its appearance, and as a storm seemed to be brewing in the Val d'Orca, and there had been frequent flashes of lightning earlier in the morning, we gave up the search, and at 7 A.M. proceeded on our way.

A singular path up a rocky aiguille, where no one would have expected to find a pass, led to the summit, which we gained at 7.30 A.M. On some neighbouring patches of snow we came upon fresh Bouquetin tracks, but unfortunately the animals themselves had disappeared. The height of the col is 8624 feet, according to a barometric observation, and the view singularly wild. In the direction of the Valsavaranche the sky was cloudless, and a fresh northerly breeze gave hopes of a continuance of the fine weather, which had now become a matter of course rather than of anxious speculation.

Soon after quitting the summit we saw before us two lakes partially covered with snow, from which the col itself was quite free, and almost immediately afterwards the noble form of the Grivola came in sight. Its appearance on this side is quite different from that which it presents as seen from the valleys of Cogne and Aosta, no snow being visible on its black and frowning crags, which towered up in savage grandeur to a lancet-shaped point, of which the accompanying illustration from an outline



THE GRIVOLA FROM BELOW THE COL DE NIVOLET.

made on the spot will convey a tolerably faithful idea. With such a feature the view cannot be called dull; but the immediate scenery was decidedly tame, reminding me of the tedious descent from the Furka to Hospenthal and Andermatt, on the St. Gotthard. Lower down we came upon a marshy plain intersected by a number of winding streams fed by the melting of the snow, and the lakes already alluded to, and which had several times to be

forded. This was succeeded by a ridge of rocks forming a low barrier across the valley, and presenting some of the finest illustrations of former glacier action that I have ever met with. The polished and striated surfaces are most extensive, reaching to a great height on the flanks of the range to the east, whilst the '*blocs perchés*,' surpassed anything I have seen elsewhere. They might have been reckoned by hundreds, and were of all sizes from that of an egg to boulders weighing five tons. Many rested on steep slopes of highly-polished rock, where the slightest impulse would have sufficed to set them in motion, but I need hardly say we were not such Vandals as to put their instability to a test which, to gratify an idle curiosity or to furnish a moment's senseless amusement, would have effaced the interesting and instructive record of past physical changes. To the fact that this district is comparatively little known, their preservation is probably mainly due, and long may they be spared the invasion of the name-cutting, souvenir-collecting tribe.

After traversing for nearly twenty minutes this wonderful scene of ancient glacier exploits, the edge of an abrupt descent was reached, and suddenly a grand view of many peaks streaming with glaciers, and forming the continuation of the chain of the Grivola, was disclosed on our right. Of these the Grand Paradis, nearly opposite the point on which we stood, was the most conspicuous, the graceful forms of the Cima di Charforon, La Cocagna, and the Becca di Merlet, completing the group which formed the east and south boundary of the more easterly of the two arms into which the Valsavaranche divides at Pont.

The charm of surprise, and the exquisite beauty of the scene, were so seductive that I was strongly tempted to change the point of attack, and attempt the Paradis

instead of the Grivola. But my holidays were now drawing to a close, to accomplish both was impossible in the time I had to dispose of, and so, considering that the Grivola had all along been my special object, and was undoubtedly the harder nut of the two to crack, I resolved to abide by my original determination. The reprieve of the beautiful Paradis was, however, but a short one, and if I was guiltless of placing the first desecrating foot on the King of the Graians, I had the satisfaction of knowing that its subjugation was effected by a friend whose narrative of the ascent appears in this volume. In 1861 I had the pleasure of following with Bennen and Perrin in the footsteps of Mr. Cowell and his companions, but will not here allude to the expedition further than to say that I deposited on a rock a little below the summit (and close to the bottle which now contains the names of Messrs. Cowell and Dundas, as well as my own, and those of our respective guides), a minimum thermometer, to which I would direct the attention of future comers. From two boiling point observations made at the same time, the height comes out 13,300 feet, or only 300 feet higher than the Grivola.

A cross stood near us, from which this spot derives its name of the Croix d'Aroletta. Its height, according to a sympiesometer reading taken in 1861, is 7,451 feet. On that occasion I made a curious discovery in the shape of twenty or thirty desiccated frogs' heads arranged in lines like the squares of a chessboard, on a flat stone, by the side of the path, and close to the cross. How, when, why, and whence they came there, remains a mystery which I offer for those interested in such obscure speculations. The little village, or cluster of chalets, called Pont, is seen at a depth of 1000 feet below, the descent to it being accomplished by a rough but well-engineered

path, which zigzags down the cliff like an expurgated edition of the Gemmi, with the objectionable parts omitted.

It was not yet noon when, after descending the rocks and traversing slopes abounding with more "*roches moutonnées*" and "*blocs perchés*," we reached Pont, situated at a height of about 6400 feet, just where the two branches of the upper part of the Valsavaranche unite. Proceeding about a quarter of an hour further to the alp of Jean Pierre Jocale, a particular friend of J. Tairraz, we found that he was absent, but received a warm welcome from his younger brother, who was in charge of the establishment, which consisted of fifty-three cows, forty-one of them Jocale's own property. Liberal supplies of "*Brousse*" were at once served out, and, stretched upon the grass before the chalet, we spent nearly three hours in pleasant chat and idleness. On the occasion of my second visit to this valley in 1861, I passed the night here, previous to the ascent of the Grand Paradis, which rises behind and to the east of it, and was then also entertained with an amount of hearty, disinterested kindness, of which I cannot speak too gratefully. The height, as deduced from the mean of two sympiesometer observations, comes out at 6131 feet.

At 2.45 P.M. we wished our kind entertainer good-bye, and started once more for Bien, Jocale's head-quarters, a little above Valsavaranche, the *chef-lieu*. Traversing one or two reaches of the valley, we arrived, after a walk of three quarters of an hour, at a spot where the richly pine-clad sides close in, leaving just room for the river and the path. Crossing to the east bank by a wooden bridge, we descended the wild but beautiful gorge, the gap in front being filled by the mountains on the further side of the Val d'Aosta, whilst to the right, the Grivola, and to the left,

a fantastically rugged chain of aiguilles, pierced the deep blue sky. Rich forests clothed the western slopes, and the valley before us lay basking in the warm sunlight, whilst our route was still in delightful shade.

At 4.15 p.m. Jean Pierre's house at Bien was reached, and though he was absent repairing a bridge further down the valley, Jean Tairraz's well-known face was a ready passport to his mother and sister, who made us welcome, and pressed us to take refreshments. Whilst waiting Jocale's arrival, I sent for the two Gardes-chasse, Fidèle Ambroise Dayné and Jean Michel Chabot, in order to talk over with them the question of the Grivola. They were absent at the time, but we were assured that directly they returned they should be sent to us; and so there was nothing to be done but to make ourselves as comfortable, and enjoy ourselves as thoroughly, as we could. This was no difficult task. I had some old newspapers to read up, and the hours flew rapidly and joyously by, till an exquisite sunset, tinging the light fleecy clouds which floated before a gentle northerly breeze, closed a day of unsurpassable loveliness.

At last Jean Pierre made his appearance, and a glance at his sensible, but jovial and hearty face, at once confirmed the pleasant impressions that had been steadily forming round his name. "*Aha! voilà Jean Tairraz, et deux autres Messieurs! Bon! bon! Plaisir de vous voir. Mangez et buvez, je vous en prie! Allez donc, la sœur, apportez du vin! Et la petite, Jean, va t'elle bien? Tant mieux! Bon! bon!*" poured from his lips in rapid succession, as he rattled on, good humour oozing out at every pore; and "*la sœur*" had a busy time of it for some minutes. Supper over, he conducted us to a clean and comfortable "*Grange*" at the back of the house, where

hay, pillows, and *couvertures* had been deposited.* Chabot now arrived, but it being too late to discuss plans, we put him off till the morning, arranging that he and Dayné should make their appearance at 6 A.M., and accompany us in an expedition to the Grivola.

* There is now a homely but decent little inn, the Hotel de Niuolè (Nivolet) at Valsavaranche, a short distance below Bien, presided over by one Victor Blanc, who, as well as his brother Jacques the Syndic, (the latter owns the Alp of Boconeire, immediately east of Valsavaranche, and just beneath the cliffs of the Grivola,) is an excellent fellow. The resources of the house are indeed limited; but meat, cheese, bread, first-rate wine, and at any rate one clean bed, may be depended on. I passed a night and part of two days here in 1861, and retain a very pleasant recollection of my stay.

2. A NIGHT BIVOUAC ON THE GRIVOLA.

BY F. F. TUCKETT, F.R.G.S.

WE were up at 5 A.M. on the seventh, and soon the Gardes-chasse made their appearance, punctual to the appointment, and looking up to their work. Breakfast despatched, grand preparations were made for provisioning our rather large party, now still further increased by the addition of another volunteer, Balthazar Leonard Jocale, Jean Pierre's brother.

It was between 8 and 9 A.M. before our start for the Grivola was effected, and 9.45 A.M. when, after winding up through the woods behind Bien, and skirting the path to the Col de la Combe de Cogne and the Livionaz alp, we reached the châteaux of the same name. An examination of the Grivola from the Croix d'Aroletta had led Jean, Victor, and me to select a different course, more to the north, and above the village of Valsavaranche and the alp of Boconaire; but the Gardes-chasse insisted that the direction we were taking was the only practicable one, and we foolishly yielded our judgments to their presumed local knowledge.

The châtlet of Livionaz is pleasantly situated at a height of 7600 feet, and here we halted awhile to rest the rather heavily laden porters, as the heat was almost overpowering. The Berger told me that in the Val Savaranche cows are worth from 150 to 200 francs, and the hire of one for the season costs about 20. The shepherds' pay is 50 francs for the season, and their food,—the principal Berger who

has the direction of the establishment receiving from 130 to 150.

After a halt of three quarters of an hour, we proceeded on our way, and turning round to the right, in a south-easterly direction, followed a little valley between the slopes to our left, and a spur which descends from a snowy summit called the *Pointe de Livionaz*. At its upper extremity, which we reached at 11 A.M., is a solitary *châlet*, above and beyond which other pasturages appear. We now turned sharply to the left, passed a fine waterfall on the right, and ascending steeply, found ourselves after twenty minutes' climb at the bottom of another upland valley, over the head of which *Cogne* may be reached, either by the *Col de la Combe de Cogne*, or by a higher and more difficult pass further to the south.

Following the course of the stream for some distance, we halted for luncheon till 12.40 P.M. A serious obstacle now presented itself in the shape of a line of cliffs, rising to a height of 600 or 800 feet on our left, and succeeded by a steep slope of snow, which was followed by a second rocky ridge. It looked ugly, but up it we must go, in order to approach the *Grivola* from this direction; so, putting on our gaiters, and mounting the snow-covered talus of *débris* at the foot of the rocks, we commenced the climb at 1.30 P.M.

Zigzagging cautiously, the obstacle was at length surmounted by all but poor *Balthazar*, who soon announced his preference for the security of the valley, and took leave with a rueful countenance. Showers of stones had at times to be dodged, and extreme caution, causing much delay, was necessary at those spots where the meltings of the snow above, trickling down in streams, covered large surfaces of rock with moisture, converted by the night's frost

into a thin glaze of hard ice, against which our axes were powerless. The summit gained, however, we encountered a far more formidable enemy in the snow-slope, 200 or 300 yards in height, lying at an angle of about 40° , and resting at a depth of less than a foot on hard bluish-green ice. Here was a fix! for after our experience on the Aletschhorn, two or three weeks before (described in another paper), we did not like the look of the snow, which was exactly in a state favourable for the production of avalanches. It was, however, useless to give way to discouragement, and we therefore pushed forward rapidly for a little rocky islet, as large as a table, which projected about two feet above the snow, near the middle of the slope. This reached, we were congratulating ourselves on our progress and safety, when suddenly some one dislodged a moderate-sized stone, which rolled down upon the snow, and instantly the entire layer we had been traversing slid away with the well-remembered hiss, and bounding over the edge of the precipice where we had stood ten minutes before, extended for some distance on either hand, in a line of snowy breakers, and went crashing grandly down the rocks beneath. A distance of 150 yards still divided us from the cliffs in front: on this part of the slope the footing was of course equally insecure, and it may be supposed that we lost no time in effecting the passage over its treacherous surface.

Then came more climbing over slippery rocks, which at first seemed rather to try the nerves of our chasseur friends; but at length, about 4 P.M., we were rewarded, in turning an angle and gaining the crest of the ridge, by the sudden apparition of the majestic peak of the Grivola, seemingly in such close proximity, that we began to indulge a hope of effecting the ascent the same day, and possibly even regaining the valley.

A more careful inspection, however, disclosed a slope about a quarter of a mile in breadth and extremely steep, covered with loose snow, with intervals of hard ice, and a few scattered rocks intersected by precipitous couloirs. Extending between us and our intended victim, it ran up on the right to a sharp ridge, which, like a curtain, connected the summit*, on whose western arête we were now standing, with the great rocky tooth that confronted us. We proposed to attain the ridge at the southern foot of the final peak by traversing the snow-slope diagonally, but Dayné at once declared that nothing should induce him to attempt the transit. We pointed out to him that he could not return alone, and that, as we were determined to effect our object, he had better remain with us. It was of no use, however. Good cragsman as he is, he would not trust the treacherous snow, and announced his intention of facing the slope to the right, striking the ridge at the northern foot of "La Blanche," and then following the snowy arête northwards, to where it abuts on the rocks of the Grivola. We again endeavoured to dissuade him, being perhaps more alive than he to the danger of this proceeding, but as he still persisted, we wished him success, and losing no more time in fruitless discussion, parted with mutual injunctions to prudence and caution.

After about three quarters of an hour we reached a double rocky tooth which, cropping out midway, was divided by a couloir, and were glad to find ourselves once more on solid ground, and able to rest for a few minutes.

Our progress had been slow and laborious, requiring

* This is called La Blanche in Carrel's "*Chaine de la Grivola vue de la Becca di Nona*" (2nde édition corrigée, Aoste, 1861), where the ridge, or curtain connecting it with the Grivola, and forming the western boundary of the Glacier du Stragio, is clearly shown, though of course in the opposite direction to that referred to in the text.

the continuous exercise of the utmost care to prevent an accident, as the soft, incoherent snow, resting upon ice, threatened momentarily to give way, and the inclination of the slope was so considerable, and our course so nearly horizontal, that even when the ice was exposed it was not always easy to maintain a footing in the axe-steps.

After a short halt, we moved forward again; Victor in advance, I following, with Jean behind, all three roped together; while Chabot, who positively refused to be attached, brought up the rear. Victor had just traversed the couloir of hard ice already alluded to, and was preparing to render me any assistance I might require in crossing, when just as I had set one foot in the first step, a slight noise on the right caught my ear, and looking up to the cliff which terminated the couloir, some sixty or eighty feet above, I saw little pellets of snow chasing one another over the edge, and descending towards me. I knew only too well that these were probably the advanced guard of an avalanche, which I suspected was caused by Dayné, and then came the thought that perhaps he would be swept down before our eyes, whilst we should be utterly powerless to assist him, and might even be involved in his fate. Instinctively I drew back to the firmer footing of the friendly rock, whilst Victor did the same on his side, just in time to allow the mass of descending snow to shoot down between us, which it continued to do for some time, beneath our outstretched rope. We shouted to Dayné to be more careful, and the avalanche having ceased, and wishing as soon as practicable to remove from so dangerous a position, I soon made a second attempt to pass the couloir. I had not, however, proceeded more than two or three yards, when down came a shower of stones, and again I was compelled to retreat.

At length the coast appeared clear, we all rejoined

Victor, and after another "*traversée*" of three quarters of an hour over more loose snow and ice, gained the ridge, and were glad to see Dayné close at hand, though in a very dangerous position. He appeared to be almost paralysed by alarm at his own recent peril (the snow had given way with him), and by the fear, caused by our shouts, lest the avalanche he had produced might have carried some of us away. As he came creeping along the slope just below the actual ridge, we could not but feel considerable anxiety, as on reaching the spot where we stood, we had discovered the existence of a "*corniche*" projecting about sixteen feet on the eastern side, and overhanging some fearfully precipitous slopes of mingled ice and rock which fell away to the Glacier du Stragio, 1500 feet below. Over this "*corniche*" Dayné's course had in places led him, and we shuddered as we saw his footmarks dinting the surface of the frail support. We dared not, however, indicate to him the existence of this hidden peril, lest it should still further unnerve him; and well it was that we allowed him to remain unconscious of it, for when at length he reached us quite exhausted, and became aware of the true nature of the risk he had run, he trembled like a child, completely collapsed, and was, in fact, unable to do anything more till the next day. Chabot also complained of uneasy sensations in the chest and stomach, loss of appetite, giddiness, sickness, and headache, partly the result of fright, and unaccustomed exertion; and partly, perhaps, due to the rarity of the air, for we had now attained a height of 12,028 feet, as deduced from the mean of three barometrical readings compared with those of M. Carrel at Aosta.

Here were rather awkward elements for a night bivouac. Two men more or less *hors de combat*, our boots and gaiters wet through, and not one square foot of level sur-

face available for our purpose to be descried in any direction. There was, however, no time be lost, it being now 6.30 p.m., and the sun getting low in the west; so, as a last resource, we turned to the rocks of the Grivola, and just where the most southerly of them descends to the arête on which we stood, we discovered, to our delight, exactly what we wanted.

The N.E. or E. wind, striking the rock and rebounding from it, aided perhaps by the sun's rays, had first flattened down, and then slightly hollowed out, the snowy ridge, thus forming a little basin or eyrie, bounded on one side by the cliff and on the other by a wreath of snow, like the curling edge of a wave, and twelve or fifteen inches in height, but open at both ends, and just large enough to contain our party of five.

It was at once resolved to send Jean and Chabot on an exploring expedition in the direction of the peak, with a view also of investigating the practicability of a descent on the eastern or Cogne side, whilst Victor and I set to work to improve our "*gîte*." A vigorous application of axe, alpenstock, and geological hammer, soon obtained a considerable supply of large flat stones, which the shaly, disintegrated rocks furnished in abundance. Having constructed a floor of these upon the snow, we next built a bank broad and long enough to afford sitting room for all, availing ourselves, for a back, of the rock which served as a shelter from what little wind there was, since it blew from the W. and S.W., whilst we faced the N.E. and E. These preparations were scarcely finished when Jean and his companion returned and announced that they had "*bonne idée*" of our chances of success on the morrow; and also thought it would be possible to effect a descent to the Glacier of Stragio, and so *viâ* Les Poussets to Cogne, thus avoiding the necessity of retracing our steps.

This was cheering information, and on the strength of it we made a hearty supper and thoroughly enjoyed the wonderful extent and beauty of the scene which we had now for the first time full leisure to appreciate.

My boiling apparatus would have been a most acceptable addition to our resources, but, unfortunately, I was out of spirits, in an alcoholic sense, and so could not avail myself of it to prepare something hot for supper. I have described its action in a note to my paper on the Aletschhorn; but though I have there spoken highly of its practical efficiency, I confess that it is likely to be thrown into the shade by a contrivance described to me during one of my many visits to the *Æggischhorn*, by a French gentleman who was also staying at the Hotel de la Jungfrau. The personage in question had amused us for some days by appearing every morning in a mackintosh, his waist encircled by a piece of stout string, and his throat by two, and sometimes three towels, whilst a conical nightcap of ample proportions completed an *ensemble* that would have done honour to an alchemist. Coming into the *salle* one day, whilst I was occupied in recording the readings of a hygrometer, he began a conversation with the following remarks: "Monsieur est homme de science?" "Non, monsieur," I replied, "mais c'est vrai que je m'occupe un peu de la météorologie, en amateur." "C'est égal! vous avez du moins des goûts scientifiques." I modestly pleaded guilty. "Vous savez donc, sans doute, ce que c'est que la chaleur rayonnante?" "Mais oui, monsieur, certainement." "Bien! je vais vous dire quelque chose que je ne voudrais pas confier à tout-le-monde." "Monsieur me fait trop d'honneur." "Au contraire! Mais fermons la porte avant d'en parler." The door was accordingly shut and locked, and, placing his back against it, he proceeded with great rapidity, and in an excited

manner, to pour out the following statement. "La chaleur existe partout, rayonne de tout. Eh bien! voilà mon idée. Par le moyen d'un petit appareil de mon invention, je parviens à extraire cette chaleur rayonnante émise par tous les corps après être exposés au soleil, et je m'en sers à volonté. Ah! que mes travaux porteront des résultats précieux pour tout le genre humain, et surtout pour des voyageurs et explorateurs tels que les honorables membres de votre Club. Par exemple, la chaleur rayonnante est une propriété même de la glace vive." I here interrupted him to remark that a celebrated "philosophe Irlandais" was said to have discovered how many snowballs it would take to boil a teakettle, a fact which appeared new to him, and was admitted to have an important bearing on his own "travaux." Again he rattled on. "Vous faites, vous et vos amis, une course sur le grand Glacier d'Aletsch là-haut, par exemple, et vous voulez préparer du déjeuner, du diner, une petite collation, n'importe quoi. Mais, que faire? Rien que de la glace partout; point de charbon; point de bois; absolument rien à brûler. C'est vrai n'est ce pas? Bien! écoutez donc! En vous servant de mon appareil vous aurez le moyen d'extraire la chaleur rayonnante du glacier lui-même et—paff!—monsieur est servi, et vous aurez du chocolat, du thé, du café, des œufs, des bifteks, enfin tout ce que vous voudrez, à l'instant. Ah, que la science est belle!" I found, on descending to matters of detail, that a few "perfectionnements" were still wanting to complete the wonderful invention; and as my friend was anxious that it should be brought out in England, and I, of course, could not decline the honour, I furnished him with the name and address of the Secretary of the Alpine Club, a liberty for which I now beg to offer my very best apologies.

The view embraced the range of the Pennine Alps from

the Col de la Seigne to the Col d'Ollen, except, of course, the small portion cut off by the peak of the Grivola, which comprised the summits between the Great St. Bernard and the Col de Collon. To the west were the mountains, glaciers, and snowfields, south-east of the Little St. Bernard, including the Rutor, Sassièrè, Ormelune, and many more; and above them, in the remoter distance, rose the grand, rugged forms of the Oysans group in Dauphiné, exquisitely sharp and clear as seen cut out against the straw-coloured sunset sky. Still further to the left, or south, the then unscaled pyramid of Monte Viso shot majestically upwards, whilst in the same direction, but nearer to us, the lofty giants of the northern Cottians were to be distinguished. Due south, and apparently connected with the Grivola by a continuation of the arête on which we stood, rose the Becca di Montandeni and the Grand Paradis, streaming with glaciers; on their left followed the summits which bound the Cogne valley on the south, the Tour du Gd. St. Pierre, Punta di Lavina, &c., stretching away eastward towards the Fenêtre de Cogne and the Val Champorcher. The remainder of the circuit was occupied by Mont Emilius and the Becca di Nona, both now below us, which carried the eye round again to the chasm of the Val d'Aoste and the huge massif of Monte Rosa. Looking towards the south, the Val Savaranche lay deep and blue beneath on our right, whilst that of Cogne occupied a corresponding position on the left, though at a greater horizontal distance.

The evening was gloriously beautiful, with just enough of cloud to furnish some exquisite effects, without in the least marring the sharpness of every outline and detail, and as these guardian spirits of the thirsty earth twined their rosy chains about the rocks, they presented the embodiment and realisation of Shelley's striking image —

“And when sunset may breathe, from the lit sea beneath,
Its ardours of rest and of love,
And the crimson pall of eve may fall
From the depth of heaven above,
With wings folded I rest, on mine airy nest,
As still as a brooding dove.”

So still was the air, and so little did the occasional breeze from the south-west inconvenience us, that at about 8 o'clock, although it was already freezing, I had no difficulty in adding a second shirt to my toilet for the night, without feeling the slightest chill during the operation. The sunset was gorgeous in colouring, and after watching the last rosy tints disappear, I set up my barometer, and enjoyed for some time, in undisturbed quiet and silence, the contrasted effects of brilliant moonlight. Amongst these was the reflection of the moon in a little solitary tarn, high up in the bosom of the range, separating the head of the Val de Rhêmes from the Val Savaranche, and which shone like a spot of gold from out the deepening gloom of the lower peaks and valleys, so that, at first, I mistook it for some shepherd's fire. Thus occupied, I took no note of time, and it was 9 o'clock ere I joined the rest of the party, who had already betaken themselves to our dormitory.

Here I found the four huddled closely together upon the stone seat; one of our blankets having first been spread upon it, and then brought up over the toes, whilst the other, after passing under the feet, was held up to the neck so as to protect the legs and chest. Squeezing myself down beside them, I immediately perceived that by this arrangement directly I dozed off I must inevitably drop the covering and be completely exposed to the cold night air. Remarking this to Victor, he at once assented to it, but added, “*dans le cas que monsieur pense qu'il pourra dormir, ce que je doute beaucoup,*” and

as sleep really did not seem very probable under the circumstances, I held my peace.

The stones on which we sat seemed to get harder and harder, but in spite of it all, drowsiness came on at last, and a little before 10 P.M. I caught myself more than once dropping off for a minute or two at a time, and of course letting the blanket fall. From one of these dozes I was suddenly roused by a flapping noise which, on peering out into the moonlight, I at once perceived was caused by a piece of linen stretched upon two batons across the north end of our sleeping-place. Drawing the blanket once more over my face, I was again becoming drowsy, when the sound was repeated, and this time Victor and Jean also were disturbed. The idea struck all of us at once that the wind must have changed, a suspicion which another five minutes only too fully confirmed. The flapping soon became constant, and a fresh north-east breeze blew directly in our teeth, with momentarily increasing violence.

Our boots and gaiters were already frozen stiff and hard, and all chance of rest seemed at an end, whilst, to add to our perplexity, the two chasseurs announced that they could stand it no longer, and if they remained in their present exposed position, they should certainly get frost-bitten. We therefore gave them one of our two blankets, with directions to cover themselves up in a small recess on the other or south side of the rock, where they would be protected from the wind; and, wrapping the other about us, Jean, Victor, and I huddled closer together and tried to face it out. It was all in vain however, and by 10.30 P.M. our stock of animal heat was so much reduced that, in spite of all we could do, the cold was rapidly benumbing us, and we could not control the disposition to shiver. Seeing the uselessness, if not

danger, of persisting, I suggested that we should break up our encampment, and either endeavour to find some less exposed position in which to establish it, or, if this were impossible, beat a path along the arête for a short distance, and tramp up and down till dawn, which we might calculate on welcoming about 3 A.M. This idea not meeting with much acceptance, I next proposed, as the only other alternative, that we should demolish our seat, and by driving the large thin stones composing it into the frozen snow, construct a slight low wall which would serve as a barrier, and partially at least break the force of the wind, whilst the exercise would help to warm us a little. No sooner said than set about, and in five minutes we were snugly coiled up in our one blanket upon the stone floor with which we had fortunately covered the snow.

Here we were in comparative comfort, though occasionally the wind would insinuate itself in a way that was anything but agreeable; and failing to batter down our defences by a front attack, contrived to turn them every now and then, and made vigorous assaults on unavoidably exposed points, such as nose, ears, and feet. However, we all dropped off at last; though feeling a little uneasy about a huge cumulus cloud, which hung at about our level midway between us and Monte Rosa, and consequently in the direction of the wind. At short intervals it was illuminated by very peculiar electrical discharges, unaccompanied by thunder so far as we could detect.

After what I imagined to be a few minutes' doze I awoke, feeling rather stiff and tolerably chilled, though not to an uncomfortable extent; and, on looking at my watch, which I had some difficulty in getting at without disturbing my companions, found to my astonishment that it was 1.30 A.M., and that I had consequently had three hours' unbroken sleep. This was indeed a triumph;

and finding my bed-fellows moving, I communicated to them my discovery, to their great delight. Then we all agreed to turn, an operation which, jammed together as we were for the sake of warmth, was of course impossible except by mutual consent. This done, we composed ourselves again; but now a new enemy made its appearance, and, sad to say, under the guise of friendship, or rather under the shelter of our blanket, which now sent forth its animated hosts to plague our weary limbs. What a half-hour was that which followed! What havoc they made, secure of perfect immunity from the impossibility of self-defence, and possibly urged on by the necessity for vigorous exertion to keep up their own circulation! At length desperation made us callous; "nature's soft nurse" came to the rescue, and unconsciousness cast a veil over our woes. When next we roused, we could congratulate ourselves on having passed the night; it was nearly 3 A.M., and the first faint indications of daybreak were already visible in the east.

Never shall I forget the splendour and solemnity of that dawning, as, rousing from our lair and shaking ourselves by way of performing our toilet, we stood watching its unfolding. The air was once more perfectly still, the keen frost had bound everything around in its icy grasp, and not a sound disturbed our contemplation of the wondrous spectacle that was being unrolled before us. The great murky cloud that had threatened us during the night like an ærial battle-ship fired, as it were, an accompaniment of minute guns, but muffled, so that their boom was scarcely audible. Above our heads the canopy of night rolled slowly westwards like the smoke of battle, sharply defined along its eastern edge by a roseate line, such as I had observed on the Breithorn ten days before, where its murky mass first caught the morning light.

Hardly had we had time to observe this grand cosmical appearance of the earth's shadow projected into space, when turning again to the eastward our attention was riveted by one of the most extraordinary effects I ever witnessed. The rising sun had just struck the pile of cloud, lighting up its skirts into a gorgeous framework of gold and orange, whilst its mass assumed by contrast the inkiest hue; when in a moment this latter was rent asunder, and rolling to the right and left disposed itself in the form of two gigantic portals through which, in rapid succession, alternate forked lightnings darted forth. The whole was so dramatic and lifelike that, glancing once more towards the west, the idea involuntarily suggested itself of the night drawing off its discomfited forces, but leaving a rear-guard to dispute the ground and check the sun's advance. All was of no avail, for soon the cloud-ship began to detach masses to the right and left, changing its form at every instant, and at length fairly giving way as the sun rose higher and bathed the sea of peaks in an atmosphere of rosy light. Its rays soon struck us, and such was their power that in a very few minutes we were glad to retire for shelter to the other side of the rock.

Here we found Chabot and Dayné in rather sorry plight, but after thawing themselves for a few minutes in the warm sunshine, both brightened up, and Dayné announced that he was all right, whilst Chabot still complained, and had evidently not yet got over the indisposition of the previous evening.

It was now resolved to breakfast leisurely, and not attempt to attack the final thousand feet of rock till the sun had gained more power; for a slight examination showed that we should for the greater part of the distance again have to contend with a coating of ice, too thin to

allow of steps being cut in it, but too firmly adherent to be removed by blows; and we hoped, as the morning gave every promise of a hot day, that a little patience would do much to remove the obstacle.

With a sense of having already overcome sufficient difficulties to warrant the hope of complete success, we were a merry party at our lofty breakfast table, and, the meal despatched, had still ample time to study in its minutest details the wonderful view. To the particulars already given, I will only add that, whilst including a much more commanding survey of all the features described by Mr. King as visible from the Poussets (considerably more than 1000 feet below us), it also embraced the glorious panorama of the Graian, Cottian, and Dauphiné Alps to the south and west, which is entirely hidden at the last-named station by the Grand Paradis and Grivola, with the intervening summits.

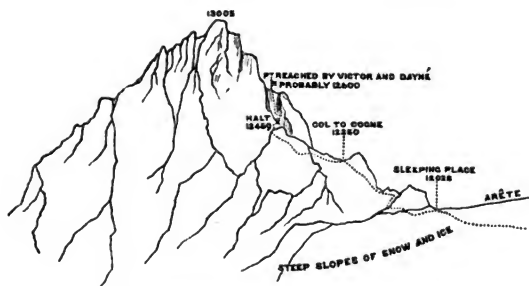
At length, feeling that if we delayed too long we might find the descent to Cogne extremely difficult, if not impracticable, and run considerable risk from avalanches, we collected our traps, and at 5.30 A.M. addressed ourselves to our rocky climb. At first this was not steep, but great caution was requisite, and we had frequently to quit the ridge itself and seek a passage across the rocks, couloirs, or slopes of snow and ice, that fell away on either hand with dangerous rapidity. Three quarters of an hour of this work brought us to a slight depression or col in the arête, some hundred feet higher than our sleeping-place (about 12,250 feet), and apparently affording the means of descent to the level of the Glacier du Stragio; whilst immediately beyond and above it, to the north, rose the grim and almost vertical-looking rocks up which our course must lie if we would win the goal.

Before ascending further, we decided that it would be

more prudent to secure the means of retreat; so, calling a halt, we despatched Victor and Dayné to examine the slopes leading to the Stragio. This glacier is shown in the sketch, page 268, where the point on which we stood is seen on the ridge to the left, or south, of the jagged rocks of the Grivola. In about half an hour the explorers returned, and reported the snow to be in a state which would render much delay on our part extremely undesirable; but they thought the descent might be accomplished if we could manage to traverse some slippery rocks, about 800 feet beneath us, and nearly as much above the glacier, where it would be necessary to shoot a couloir of ice, and trust to being able to pull up at the bottom.

This point being so far settled, we rested yet a few minutes to enable Victor and Dayné to recover their breath, and at 7.40 A.M. addressed ourselves once more to our task,—leaving Chabot, who still felt much indisposed, on the ridge with our baggage, to await our return. For a short distance we got on pretty well, though the coating of ice on the rocks gave us much trouble, and my barometer was a terrible nuisance, always contriving to swing round and catch against projections, or jam itself between my legs at the most critical moment, when it was all I could do to maintain my hold, with hands, knees, and feet in active requisition. At length, on reaching and turning an angle of the cliff, a most formidable obstacle presented itself, in the shape of a “*cheminée*,” sixty or eighty feet in height, the bottom of which could only be gained by crawling over highly inclined rocks, covered with an almost unbroken sheet of hard ice. As the true direction might not lie up it, whilst its ascent appeared to be the only practicable means of getting higher, Victor—“ready, aye ready,” as a Napier, at a pinch—offered, if Dayné would accompany him, to endeavour to scale it,

whilst Jean and I waited to learn the result, before following. We therefore established ourselves as comfortably as we could where we were, and I occupied myself in making a barometric observation,—a matter of no little difficulty, as my hands were wanted to hold on. By comparison with Aosta, the height appears to be 12,459 feet, or 546 feet below the summit of the mountain. A quarter of an hour's scramble at length placed Victor and his comrade on the spot indicated in the accompanying rough



THE SUMMIT OF THE GRIVOLA.

outline, and now came the dispiriting announcement that further progress was impossible. Three or more steps of rock rose one above the other in the direction of the summit, and being glazed with ice, afforded not the slightest foothold; whilst on the further, or Cogne side, the cliff went sheer down for hundreds of feet.

Under these circumstances, and seeing the value of time to us, I at once decided not to risk or attempt more, as I felt perfectly satisfied with what we had already done, and hoped to return some other time to complete the good beginning we had made; so, after planting a banner with a *very* "strange device," in the shape of an old handker-

chief, they redescended carefully to us, and at 9 A.M. we regained the col, where a draught of wine and snow proved most acceptable.

But our difficulties were by no means yet at an end, and for a long time it seemed anything but certain that we should see Cogne that day. Sometimes the hard but thin ice lay at so steep an angle, and was masked by so slight a coating of snow, that the only possible mode of progression was to tie one end of our rope round the leader, who then sat or crouched down, and was lowered as far as the length of the cord would permit, or till he reached a spot where he could secure a good footing; then, one by one, we slid down to him, using the rope as a rail, the upper extremity being tightly held by another of the party, who finally made himself fast also, and shooting down as gently as he could, was brought up standing by those beneath. This fun, amusing enough to all but the unlucky last man, continued upwards of an hour, and about 10.15 A.M. we found ourselves standing beneath the glorious peak, and at the west edge of the Glacier du Stragio, which alone separated us from the low rocky ridge of Les Poussets.

The glacier is here nearly level, and forms a complete *mer de glace*; but about a mile to the north the slope rapidly increases, and the mass of ice tumbles grandly downwards, threatening the Cogne valley far beneath with its huge seracs, and finally sweeps round rather to the east. This upper plateau or *névé*, which we now proceeded to traverse, must have an elevation of from 10,000 to 10,500 feet. It was thickly covered with snow, which the intensely hot sun had by this time thoroughly softened. We sank to the knees at every step, and Dayné and Chabot soon showed signs of exhaustion, but were from time to time revived by some aromatic vinegar, which I happened to possess amongst other stores; having always found it an

admirable remedy for those overcome by drowsiness or languor. Behind us, the peak of the Grivola rose in majestic grandeur; but so intense was the heat, and so blinding the glare, that thorough enjoyment of the picturesque was for the time out of the question, and we floundered on in the most apathetic manner towards the Poussets, which rose black and friendly before us. This was at length reached at 11.15 A.M., and we halted to remove gaiters, take some refreshment, and enjoy ourselves leisurely, now that all difficulty and doubt were at an end.

The view from Les Poussets, which according to my barometer is 10,729 feet in height (300 feet above the summit of the Becca di Nona), certainly merits all the praise bestowed upon it by Mr. King, though, as already remarked, it is infinitely inferior to that from our sleeping place, since the whole of the west and south-west horizon is concealed by the Grivola and its outlying ridges. On the other hand, there is the Grivola itself to atone in part for the deficiency.

Our chasseur friends were afraid to descend to Cogne with us, lest they should be seen off their beat by the corporal who resides there, so, after dividing our remaining stock of provisions with them, and presenting them, to their great delight, with a Napoleon apiece, we wished them good bye, and started off down the "*clappey*" whilst they struck off to the right, in order to reach the Col de la Combe de Cogne, and so regain their homes. We found the "*clappey*" by no means so troublesome as Mr. King's description had led me to expect; but of course it would be much more formidable for a lady, who would, at the time we were there, have been much inconvenienced by the constantly recurring patches of snow, a foot or two in thickness, and so thoroughly softened by the heat of

the sun that the feet went through it at once, and sometimes became very unpleasantly caught and wrenched in the loose jagged *débris* beneath.

About 1 P.M. we reached the pastures at the head of the lateral valley, and here, as well as for some considerable distance further down, the evidences of former glacier action were remarkably conspicuous, in the shape of magnificent "*roches moutonnées*," among which the path wound for nearly a mile. Turning abruptly to the right, we quitted the alp of Les Poussets, passed round a projecting rock, and traversing alternately woods of larch and pine, grassy slopes and cultivated fields, reached Crétaz about 3 P.M., and Cogne in another quarter of an hour.

Here I spent three hours very pleasantly in the company of Dr. Argentier, M. le Curé, Delapierre of Gressoney, and an English lady and gentleman whom he had just accompanied from Aosta. The sight of English faces was a most unexpected pleasure; but my torn clothes, burnt face, and unkempt locks must, I think, have sorely tried their gravity. In Mr. King we found that we possessed a mutual friend. "Things that are equal to the same thing are equal to one another," was again demonstrated to be a social, as well as a mathematical, axiom, and the time flew rapidly by in pleasant converse. As, however, there was still a long walk before us, and it was now 6 P.M., I was compelled to depart, and so we all strolled down together as far as Crétaz, when wishing one another "*bon voyage*" we parted, my kind escort returning to Cogne, whilst Victor, Jean, and I pushed rapidly down the valley for Aimaville and Aosta, and were not sorry to find ourselves at 11 P.M. once more under the comfortable shelter of the Hôtel du Mont Blanc.

TABLE OF HYPSONOMETRICAL OBSERVATIONS IN 1859 AND 1861.

Place.	Height.	Method.	Other authorities, &c.
Becca di Nona . . .	10,403	Barometer	10,384. Carrel.
Col d'Arbole . . .	9,160	"	9,341. Favre.
Cogne (Inn, salle) . . .	4,998	"	
Col de l'Arietta . . .	9,435	"	9,656. Favre.
Ronco (Inn, first floor) . . .	3,090	"	
Ponte (Valentino) . . .	1,689	"	
Val Pra . . .	2,712	"	
Ceresole (Inn, first floor) . . .	4,864	"	
Col de Nivolet . . .	8,624	"	
Croix d'Aroletta . . .	7,451	Symp.	
Jocale's chalet near Pont . . .	6,131	"	
Grand Paradis . . .	13,300	Boiling point	Mt. Iseran (?) of État-Major Sarde, 13,271.
Bien (chez Jocale) . . .	5,263	Barometer	
Valsavaranche (Inn) . . .	4,950	Symp.	
Châlet de Livionaz . . .	7,600	Barometer	
Grivola (Bivouac) . . .	12,028	"	
Col de la Grivola . . .	12,250	"	Estimate.
My highest point . . .	12,459	"	
Victor and Dayné's ditto . . .	12,600	"	Estimate.
Les Poussets . . .	10,729	Barometer	

Through the kindness of my excellent friend M. Carrel, I am enabled to furnish a few particulars of a very successful ascent of the Grivola, in September 1861, by M. Chamonin, curé of Cogné, and two companions, whose route will probably be adopted in future in preference to that hitherto followed. I also append a résumé of the different expeditions which have taken place up to the autumn of 1861.

1. *Sept. 21, 1858.*—M. Chamonin and A. J. Jeantet reached the middle of the pyramid by the arête between Cogné and Valsavaranche, but the day was too advanced to allow of their proceeding further.

2. *July 7, 1859.*—F. F. Tuckett, accompanied by Jean and Victor Tairraz, and the chasseurs Dayné and Chabot. The expedition just described.

3. *August 23, 1859.*—Mr. Ormsby and two friends.

This excursion is described in the present volume by my friend Mr. Ormsby.

4. *August 28, 1859.* — MM. Chamonin and Jeantet attempted the ascent by the Pouset and Glacier de Stragio (or Trajo). They gained the south-east arête without much difficulty, but again were too late (4.30 P.M.). They set up a statue of the Virgin, and saw the flag which Dayné had planted on the summit five days before.

5. *August 19, 1861.* — My friends Messrs. Mathews and Jacomb started from Valsavaranche, and would doubtless have attained the summit if Dayné had accompanied them to point out the way. As it was, their guide, who was supposed to be acquainted with it, got confused, and they were at length reluctantly compelled to return.

6. *Sept. 5, 1861.* — M. Chamonin reached the summit from the side of Cogne without encountering any serious difficulties. I now proceed to give M. Carrel's account of this expedition, merely omitting the description of the view, which, though interesting, is too long for insertion here: —

Happening to meet M. Chamonin, curé of Cogne, at Aosta, towards the end of August, I strongly urged him to renew his attempt on the Grivola, for which the weather and the season appeared propitious. On his return to Cogne, he set about the necessary preparations for this expedition, and on the afternoon of September 4th, accompanied by the chasseurs Pierre Jacquin and Sophonie Guichardaz, started for the Châlet du Poucet, which was selected for night-quarters. The herdsmen did their utmost to make them comfortable. The following morning, at 3.30, they were astir, but Guichardaz, whose left foot caused him severe pain, was unable to proceed, and one of the herdsmen, Pierre César Perrod, took his place.

Quitting the châlet at 4 A.M., they reached at 6 A.M.

the edge of the Glacier de Stragio or Trajo, the surface of which was bare and steeply inclined. To avoid slipping into the great crevasses they put on *crampons*, and attached themselves to a rope seven metres in length in the following order: Jacquin, Chamonin, and Perrod. Steps were at first cut with an axe to improve the footing, but the slope diminished as they advanced, and the glacier was successfully traversed. The last crevasse presented some difficulties, but after an hour's walk they stood on the opposite side, at the foot of the majestic pyramid. It was 7 A.M. The *crampons* and axe were discarded, and after a short halt they commenced the arduous climb. At 9 A.M. they recovered the statuette which had been left in a cleft two years before, and at 9.45 A.M. the summit was gained without difficulty.

After a moment's contemplation of the horrors and beauties which surrounded them, the two chasseurs set about raising Dayné's pyramid, and M. Chamonin, having offered up a sublime prayer, proceeded to examine in detail the immense panorama which surrounded him. Here follows a description, in M. Chamonin's own words, of the view, which concludes thus: Whilst I had been enjoying the contemplation of the mountains and glaciers, my companions had completed Dayné's cairn and again set up his banner, which was lying on the ground. They constructed a second cairn ten or twelve metres further to the south, in which was placed a little statue of the Virgin, a metal crucifix being at the same time deposited in the larger pyramid. This done, we partook of a frugal repast, amid the most agreeable emotions.

It was noon when we finally quitted this enchanting point of view and commenced leisurely descending. This appeared more dangerous than the ascent, but we accomplished it without accident, and in half an hour less.

The great crevasse at the edge of the glacier gave us less trouble, and the glacier itself proved easier. At 3 P.M. we stood in safety on the ridge of the Poucet, and halted a moment to contemplate the mighty pyramid. We saw distinctly the two pillars and the flag which we had re-planted. At 5 P.M. we reached the Châlet du Poucet, and at 7 P.M. entered our homes, delighted with the successful result of our excursion.

NOTE ON THE GRAND PARADIS.

This mountain, the culminating point of the Graians, is condemned by the Sardinian engineers (foglio 38, Cuorgne, Carte de l'État Major Sarde, 1854-5) to bear the unpronounceable name of the Becca di Lausqueour; that of Gran Paradiso being in the same map most confusingly used as a synonym for the Tour du Grand St. Pierre, a much lower summit, further to the east. In what is commonly known as the six-sheet map, published in 1841, the general term of "Ghiacciaja di Monei" is made to do duty for the monarch of the Graians. Here is a case of confusion and omission, as striking as was that creation of a daring imagination — the recently-exploded myth, Mont Iseran; and I have long speculated whether the real, but ignored, Grand Paradis, 13,300 feet in height, may not, by some strange blunder, have been identified with the visionary Iseran, to which a height of 13,271 feet has been assigned in foglio 37 of the larger survey. Quite recently my ideas have received a most full and satisfactory confirmation, for which I am indebted to the never-failing kindness of my friend Mr. W. Mathews. That gentleman having obtained access to a Mémoire by Corabœuf ("*Notice sur une mesure géométrique de la hauteur de quelques sommets des Alpes*," Rec. de la Soc. de Géog. de Paris, vol. ii. 1825), on whose authority the determination of the height of the Iseran rested, extracted the triangulation employed, and furnished me with the particulars. The second and third stations are the

Superga and Saluzzo, and on connecting these points with the respective summits of the Iseran and Paradis, on the six-sheet map, I at once found that, whilst the latter did not *precisely* satisfy the conditions, the errors were very small, on the supposition that it was in reality the summit measured. On the other hand, the Iseran agreed neither with the angles of Corabœuf's triangle, nor with the length assigned to its sides. Taking these facts into consideration, and remembering that my boiling-point observation on the Paradis gives a height only twenty-nine feet in excess of that erroneously attributed to the Iseran, whilst no other summit in the district attains a height of even 13,000 feet, I venture to think that the former mountain was the one actually determined by the engineer, who afterwards, with unaccountable carelessness, christened it by the name of the latter.

3. ASCENT OF THE GRIVOLA.

BY J. ORMSBY.

THE tourist who has descended the Val d'Aosta from Courmayeur may recollect having caught, just beyond the little town of Villeneuve, a glimpse of a sharp snow-peak that glistened for a moment through a cleft high up in the mountains on his right, looking all the more dazzlingly white for the black rocks above which it towered, and then disappeared behind the southern wall of the valley, and was seen no more. If he asked its name, he was told that it was called the Pic de Grivola, and this was all that, until quite recently, most travellers ever saw or heard of the mountain, which is the subject of the present paper. Within the last two or three years, however, the hordes of northern pleasure-seekers,—those peaceful Goths, who lay waste inn-larders, and sorely oppress mountain mules,—have invaded many a region, where solid leather portmantaus and Balmoral boots had never penetrated before. Among the new territories thus annexed to Tourland, the Cogne district seems likely to become one of the most popular. Its attractions have been already dwelt on in two very pleasant books of Alpine travel,—Mr. King's "Italian Valleys of the Alps," and "A Lady's Tour round Monte Rosa;" and the increase in the number of its visitors each summer shows that these attractions have not been over-rated. One of the chief ornaments of this district is the Pic de Grivola; and most of the tourists who visit Cogne



THE GRIVOLA, FROM THE S.W.

make the excursion to the Mont Pousset, the main object of which is to obtain that striking view of the peak which has been so well described and drawn by Mr. King. It is to be hoped, therefore, that a few words about the mountain itself may not be without interest to some of the readers of the present volume.

It was, to the best of my recollection, in a very fitting birthplace for the project of an Alpine expedition that the idea of ascending the Grivola first occurred to us. One day in August 1859, Mr. Bruce and I, together with Zachary Cachat of Chamounix,—a name that will be associated with the memory of many a pleasant excursion in the mind of many a mountain traveller,—were sitting in the ruins of De Saussure's cabin on the Col du Géant, looking out over that grand sea of peaks and glaciers that stretches away to the south and east of Mont Blanc, when Cachat pointed to something far off among the clouds, that were racing furiously over the distant mountains, and said it was the Pic de Grivola. I cannot say positively that it was the peak he saw, or that we saw what he was pointing to, for at that time the view in that direction happened to be very indistinct; but the remark had the effect of setting us talking about the Grivola,—what an extraordinary mountain it was in structure and appearance,—what grand climbing its sides ought to afford,—and, above all, what a noble view there must be from its summit. We were then in that enterprising frame of mind which one always experiences after a successful *grande course* and a satisfactory adjustment of the contents of the provision knapsack; and Zachary Cachat, as every one who has travelled with him knows, is not the man to check enthusiasm or throw cold water on any scheme if he has reason to believe "*les messieurs*" mean going. Consequently, by the time the other guides, who had slipped away on a crystal hunt, had

rejoined us, it was a settled thing that a portion of our intended sojourn in the Cogne district should be devoted to an exploration of the Pic de Grivola.

It is now, I trust, rather too late in the day for a defence of what may seem to be perfectly objectless mountain climbing. I think it is pretty generally admitted that, if a man happen to have a weakness in that direction, he may be permitted to indulge in it without being compelled to say that he is labouring in the cause of science, or—what is the most transparent excuse of all—that his incentive is the healthfulness of the pursuit. If pretexts of this sort be required, I fear we were inexcusable. We had no intention whatever of giving a helping hand to science,—partly, no doubt, from an incapacity to do so in any way; and I feel quite sure, the notion of improving our health by the expedition never once entered our minds. We were simply stimulated by the prospect of a delightful excursion, of glorious mountain scenery, and, what it would be hypocrisy to deny, by that peculiar fascination belonging to a mountain that has the reputation of being inaccessible. Whether the facts of an expedition undertaken in this spirit are worth recounting or not, is another matter. But, at any rate, the possessor of those facts, if he thinks there is any one who cares to know them, has no right to take shelter behind the old apology of “Story, God bless you! I have none to tell, sir.” The needy knife-grinder’s story is, very likely, not the most instructive, but such as it is, the Friend of Humanity was ready to listen to it; for which reason I have always considered the kicking the former ultimately received an exquisite piece of poetical justice.

Even had we been inclined to let our purpose cool, there was no wavering about the resolved Zachary. That very night at Courmayeur he made inquiries about the Grivola

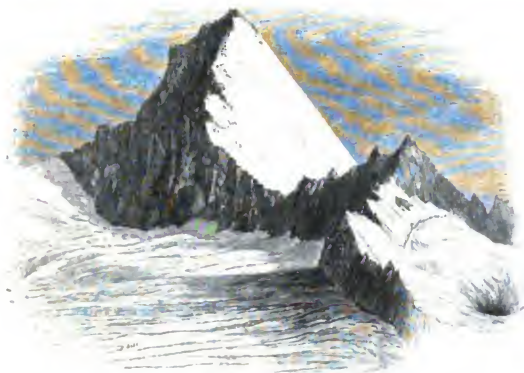
that had the effect of evoking that apocryphal chamois-hunter, who always turns up in the spirit on such occasions. Has any one ever set about a new excursion in the Alps without hearing of this chamois-hunter, who has been up every inaccessible peak, and has crossed every impassable col, but whose name and dwelling-place, strange to say, nobody can ever tell? No doubt rumours of his achievements tantalised Dr. Pacard and De Saussure when they were casting longing eyes upon the summit of Mont Blanc; and when that mountain was crowned, as we know it was, long ago, we may be sure he was the individual deputed by the neighbouring peaks to adjust "the diadem of snow." For all we know, when Hannibal was making preparations for that *grande course* which has established him as the first of Alpine travellers, he waited day after day for the appearance of that chamois-hunter, in the faint hope of being able to save his vinegar for the cucumbers of Italy.

Had we known a little more of this daring Spirit of the Alps, it would perhaps have discouraged us to learn that he had not actually been up the Grivola. He had merely found out a way. However, we accepted it as a good omen, and went on our way to Aosta rejoicing. At Aosta we got some intelligence rather more to the point. The chamois-hunter, of course, we found out to be a myth. But then we also found out that a real attempt had been made about six weeks before by Mr. Tuckett, and that our worthy host, Jean Tairraz, of the Hôtel du Mont Blanc, had been of the party. It did not require much pressing to induce that zealous mountaineer to join us. Like an ancient war-horse, he snuffed the battle afar off, and threw himself into our consultations and preparations with an earnestness that showed that the Chamounix guide was not yet merged in the Aosta landlord. He had been beaten off before, it was true, but still he did not despair.

It was well worth trying again, and in fact he had hopes, provided always we carefully avoided the route which Mr. Tuckett and he had taken. This settled the question. So without further delay we had our boots freshly nailed, bought a coil of rope that would have moored the Great Eastern, and victualled ourselves for forty-eight hours. I suppose there is something infectious about this sort of work, for a friend of ours who had reached Aosta a few minutes before our arrival, seeing what was going forward, was stimulated to volunteer for the enterprise. This addition to our party raised the question whether another guide might not be desirable; so we went to inspect one who was on view in the courtyard, and who, we were told, was "*magnifique sur les rochers.*" He may have been magnificent upon the rocks, but as we saw him in the valley, he was, not to mince matters, decidedly ill-looking. It may be a weakness, but I own to an objection against a guide with a hang-dog countenance, and to a belief that one worth his salt upon the mountains will be always found to be a jolly honest-looking fellow. Of the gentleman to whom we were introduced, as one has no right to judge by appearances, I shall merely say, that if I had a number of napoleons about me, and he were aware of the fact, I should prefer not to travel in his company on a lonely road. On these, no doubt illiberal, grounds I opposed his election; and as he, fortunately, demanded a preposterous sum for his services, I was enabled to convince the company that he was not the man for us. This was lucky, as we subsequently fell in with a couple of *gardes-chasse*, who knew the mountains probably a great deal better than the magnificent cragsman, and were unquestionably much pleasanter fellows.

As the neighbourhood of Cogné is not so well known as those of Chamounix and Zermatt, I may as well devote

a few words to the topography of our expedition. The Pic de Grivola is the culminating point of the ridge which separates the Val de Cogne from the Val Savaranche. These two valleys branch off from the south side of the Val d'Aosta nearly opposite the town of Villeneuve, about two hours above Aosta. Owing to the narrowness of the valleys, and the height and steepness of the walls which bound them, there are only two points,—one in the Val d'Aosta, the other in the Val de Cogne, from which even a glimpse of the Pic itself can be obtained without two or three hours' climbing. Seen from some commanding height in the neighbourhood, it may be roughly described



THE GRIVOLA FROM THE EAST.

as a pyramid, the sides of which face pretty nearly the four points of the compass. Those which face northwards and eastwards are snow-slopes of a length and steepness, I fancy, unequalled in the Alps. The southern and western sides are, as is almost universally the case, of bare precipitous rock,—the southern being almost perfectly

perpendicular from its crown to the glacier at its foot, while on the other, or western*, the rocks slope outwards somewhat near the bottom of the peak. The most natural and obvious route to the top of the mountain is by the arête between these two; and I have no doubt that would have been the one selected by us, had we not been aware that Mr. Tuckett had tried it and found it impracticable.

Our plan being to attempt the western face of the Grivola, we of course made for the Val Savaranche, which lies on that side of the peak, and settled ourselves for the night in the little village of Gioux, or Dégieux, just at its foot. In the article of beds we were uncommonly well off, thanks to the kindness of the curé. For refreshment purposes we availed ourselves of the auberge of the village, which was in point of fact a cellar, and rejoiced in the very appropriate sign of the "Marmot's Hole." The marmot himself was a remarkable man, who, for purposes of extortion, simulated idiocy. I remember, when we came to settle his little account, he made a demand worthy of the Trois Rois at Bâle, enforcing the same with a grin and gibber worthy of Bedlam. We, however, disallowed his claim to insanity, and insisted on treating him as a rational being by giving him exactly one third of what he asked. This line of conduct made him, I think, respect and even like us. Poor fellow! he shook hands with us at parting in a way that showed he was impressed by our acuteness in seeing through his design, and touched by our recognition of his intellect. The great fact of his life seemed to be that a potentate, whom he called the Roi de Sarse, had once used the house. Of this recollection he never tired. We used to hear him muttering it to himself in corners. While we were making our supper, he stood over us and treated us to it at intervals. If he was sent to fetch any-

* See the cut on preceding page.

thing, he would come back after having gone half-way to the door, make the communication confidentially, and then vanish. If there be any truth in the story, I can only say I trust his majesty liked his accommodation. After tumbling down a flight of steps you broke your shins over a number of tubs, containing goat's milk in various stages of decomposition. You then crossed a quagmire in the centre of the room, and so got on to some high land on the other side, where you might sit down, if you could find anything to sit upon. I believe some one discovered a three-legged stool, but I never saw it: however, there were empty tubs, and things of that sort, which did very well. To illuminate the whole—for, like that in the groves of Blarney, this was “a cave where no daylight enters,”—there was a kind of portable gallows, with a saucer hanging in chains, containing oil and wick,—a contrivance that had a knack of toppling over into your coffee or grog without the slightest notice, and giving an unexpected flavour and richness to the beverage. I don't know that I ever spent a merrier or a pleasanter evening. There was but one drop of bitter in our cup, counting the lamp oil as nothing. It was the fleas. Without any inordinate vanity, I may say that I am a judge of fleas. I have given them my attention under various circumstances and in various countries. Not to speak of an intimacy with the ordinary flea of the diligence, founded on having travelled many a league in his company, I have spent nights with hardy mountain-fleas in Swiss châteaux, with desperate *freischütz*, *wildjäger* fleas in the Tyrol, with bold contrabandist fleas in the Spanish Pyrenees, with Arab fleas, restless and lawless, children of the desert, dwellers in tents. But none of these ever impressed me so much as the natives of the Val Savaranche. Equal to any of the others in ferocity and physical vigour, they surpass them all in instinct. They

even give evidence of a kind of mutual dependence and organisation of labour, which suggests something like a dawning civilisation,—so systematic and well-sustained are their attacks. In the Marmot's Hole we were knee-deep in them. They crept up our trowsers and down our necks until we were saturated with them. They lay in wait for us in dark corners, and sprang upon us suddenly. They clung to us viciously, and bit us at supper and bit us at breakfast. They bit us sitting and bit us walking. On the mountain side, on the glacier, nay, even on the top of the Grivola, unaffected by the rarefaction of the air, unimpressed by the magnificence of the view, there they were, biting away as if they had not broken their fast for twenty-four hours. I know it sounds like effeminacy to complain of any of the hardships one undergoes on an expedition of this kind, and I hold that the man who cannot endure hunger and thirst, cold and heat, to have his nose blistered and his toes frost-bitten, has no business in the high Alps. But you must draw the line somewhere, and I draw it at fleas. They, I maintain, are a grievance at which one may lawfully murmur. Ye Gentlemen of England, who live at home at ease, how little do you think upon the danger of the fleas! But if you knew what it was, after a sleepless night, and with mind as well as body in a state of furious irritation, to start for a walk of fifteen hours, during, perhaps, eight of which your personal safety depends on your equanimity and coolness, you might, I think, agree with me in ranking this little animal with the crevasses and avalanches and other perils which beset the path of the mountaineer.

Next morning, by 4 o'clock, we were under way and climbing up the steep side of the Val Savarauche, at a spot where a glacier stream descends from the Grivola. We made, as is always the case at starting on these moun-

tain excursions, an exceedingly solemn, not to say morose, party. I suppose it is that at 4 o'clock A.M. the mind is especially disposed to take a material view of things, and cannot realise the fact that it is out for a day's pleasure. Indeed, the appearance of things in general does not tend to support such a theory. A cold blue-black sky overhead, winking in mockery at you with all its stars; cold packs of fog filling up the valleys below; cold shapes of mountains with uncomfortably sharp outlines,—the rocky ones looking black and cheerless, the snowy ones miserably blue, as if even *their* noses were pinched by the cold; add to this a half suspicion which you try to drive away, but which will come again and again, that you are doing a very absurd thing, and that if you were not a fool you would be in bed and asleep, like the happy old folks at home, and the rest of the rational world. Sensations of this sort do not produce an exhilarating effect on the animal spirits; and it says a great deal for the attractions of mountaineering that they have never yet, so far as I am aware, turned back an excursionist, or made him a bit the less ready to suffer them over and over again whenever an opportunity offers. There was one honourable exception in our case, and that was Jean Tairraz. Brought out by circumstances, as useful men always are, he applied himself to enliven the procession, which was crawling upwards as silently as if we had been mutes attending our own funerals, and kept up a running fire of jokes appropriate to the occasion, interspersed with anecdotes of his experiences in London. This spirited conduct on his part, joined with active exercise, soon thawed us, and before long we were proceeding with an animation and noise that sent the marmots whistling to their holes in sheer dismay.

In about three hours from our start we had left the last blade of grass behind us, and were worming our way up

the bed of the stream before mentioned, which was at this time of the morning a mere vein of water, trickling feebly under a skin of ice,—very different from the roaring torrent, twenty feet wide, we found on our descent in the afternoon. Up this we went, scrambling, slipping, stumbling, among ice-clad boulders and polished blocks of serpentine, until at last, turning the corner of what seemed to be a high gravel bank, we found ourselves on a moraine, with the western glacier sloping upwards from our feet, and the final peak of the Grivola rising like a wall out of the snow-field at the further side. The first sensation on seeing your work cut out for you is very curious, and one is very apt, under the excitement of the moment, to undervalue the difficulty. I remember, when it was proposed that we should halt here and breakfast, making a motion in favour of pushing on without losing any more time, and postponing breakfast till we got to the top, or at least somewhere near it,—a suggestion which I am happy to say was treated with the contempt it deserved. Indeed, a very short examination of the face of the mountain showed us that it was impossible to do anything just yet. The rocks at the foot, though they sloped upwards from the glacier at no great angle, were very smooth, and steep enough to be by no means easy at the best of times; but now, being on the shady side of the mountain, they were coated with the ice of the night to such an extent as to make them absolutely unassailable. There was nothing for it, therefore, but to wait till the sun came round. And then followed that little episode which every true mountaineer will hold in grateful recollection. Even if there were no glorious scenes, no wonderful sights to reward the climber, I *do* think an expedition among the mountains would be worth making for the sake of that “good, honest, wholesome, hungry breakfast,” as old Izaak Walton would call it, which one enjoys

on the moraine of the glacier, or in some crevice among the crags; when the sourest of bread has an exquisite flavour, and the thinnest of wine tastes like nectar; when hard-boiled eggs disappear as if the wizard of the north were dealing with them; and the tough, wiry, fatless mutton of the Alps goes down as if it had been reared on Dartmoor.

“On the Alps,
It is reported, thou didst eat strange flesh;”

but ah! what an appetite you had to eat it with!

After breakfast we proceeded to make a more deliberate survey of the mountain, and to arrange the plan of attack. On our right was a snow-ridge, ending in the jagged arête, on which Mr. Tuckett spent the night when making his very plucky attempt of the 7th of July. On the left was another arête, uniting with the ridge which separates the two valleys. Between these two rose the peak itself, terminating in a square top, which seemed from where we stood to be about an inch broad. The peculiar arrangement of the rocks, which we afterwards found to be composed of mica schist, gave it a strange striped appearance, the strata showing in strongly-defined bands of alternate red and grey, with a slight dip to the north. From top to bottom it seemed to be furrowed with couloirs, up some one of which we proposed to ascend. After a little it became evident that our choice lay between two, and we resolved ourselves into a committee of the whole party to decide on their respective merits, which proved to be so nicely balanced that it was agreed to give a casting vote to Cachat. Invested with this responsibility, he withdrew in company with telescope, and put himself in immediate communication with mountain. Every one knows a picture representing the late Napoleon Bonaparte standing on a rock at St. Helena, with a spy-glass to his eye. If

we subtract the tails of the coat, and throw in a tooth-ache, from which the poor fellow was suffering, owing to the intense cold, this print will give a very exact idea of Zachary as he stood on the moraine, examining every crevice and scrutinising every square inch of rock over which it might be necessary to go. At last we saw him shut up the glass with an air of "*conclusum est contra Grivolam*," and then we all felt the thing was as good as done. But not just yet; for the sun was in by no means so great a hurry as we were to get to the top of the mountain, and until he shone upon it there was no use in moving. So for a weary hour up and down that wretched moraine we trotted, indulging in all sorts of gymnastics to keep up the circulation. A more intense cold I don't remember ever feeling. I believe not one of us would have ventured to make an affidavit, founded on sensation, that he had a nose, though a blue projection to that effect was painfully conspicuous on the countenance of each of us. And then, to aggravate our misery, there were the peaks on the opposite side of the valley looking rosy and warm and comfortable in the rays of the morning sun. While matters were in this state, an incident occurred which helped to while away the time. Ambroise, one of the *gardes-chasse* before mentioned, who had been examining the rocks with his telescope (an awful instrument about four feet long and made of pasteboard), suddenly jumped up with a shout of "*bouc, bouc!*" and there on the arête to our right stood a bouquetin in the flesh. For a minute or two we had a good view of him, and I recollect being particularly struck with his great depth of carcase, and his action, which had all the long sweeping stride of the stag, and nothing whatever of the jerky goat-like gait of the chamois. It was mortifying, but I do not think he condescended even to look at us, but dis-

appeared sulkily on the other side of the ridge,—I have no doubt cursing in his heart the maniacs whose noise had made him get up before his regular time.

As the bouquetin went down the sun came up, and almost instantaneously the whole face of the mountain was changed. The thermometer stood too low for poetry, otherwise it must have reminded some one of the "Sleeping Palace," when, all over the side of the mountain, little streams woke up at the kiss of the sunbeams, and began to trickle jovially over the rocks; and the glacier torrent at our feet stretched himself in his bed and took to the business of the day, murmuring and grumbling among the boulders, and, in fact, all the long-pent stream of life dashed downward in a cataract. We, too, shook ourselves, and "renewed our strife" with the Grivola.

A few minutes brought us across the glacier and over the snow; and then commenced the struggle with the rocks. For a while it was all plain sailing. The rocks, though uncomfortably smooth and slippery, were sufficiently shelving to make our work easy enough. Presently, however, they began to change their character, becoming more and more treacherous, while the slope increased in steepness at every step. For about two hours we worked our way slowly but steadily upwards, now scrambling on hands and knees along the back of some projecting buttress of rock, now crawling up some couloir in that attitude which the serpent has been condemned to adopt, at every step sending down showers of stones, with constant shouts of "Look out," or "*Gardez vos yeux*" (Anglo-French for "mind your eye"). At last we reached a spot where something like the battlement of a ruined castle, broken by embrasures, ran across the mountain from side to side. Creeping through one of the breaches in this wall, we found ourselves on a little platform, with the

crown of the peak rising straight up some hundred feet above our heads, and in front of us a long narrow couloir, which, as far as we could see, seemed to run right up to the top. Ambroise, who was leading, made a dash at this with his favourite war cry of "*Nous montons, nous montons.*" I, being next, followed suit, and in about two seconds had attained, for the first time in my life, to a perfect knowledge of what is meant by the expression, hanging on by the eyelids. The sides and bottom of the couloir were worn almost quite smooth by, no doubt, frequent discharges of stones from above; and what little projections there were, being crumbling mica schist, yielded to the hand, foot, or alpenstock with the utmost alacrity, so as to make progression more peculiar than pleasant.

Nothing is harder, in describing a place of this sort, than to avoid making it seem worse than it really was. The simple facts, when put into words, have very often a certain flavour of the terrible about them which does not belong to them in nature. For instance, a spot where a single false step would dash you to atoms has an ugly sound; and yet scenery has been enjoyed, dinners have been eaten, and pipes smoked, in perfect comfort in such situations; for why should that single false step be made? Thus, without any great departure from the simple truth, this couloir might be made out to be something rather ticklish; indeed, as my companion afterwards observed, with the aid of a little word-painting it would be possible to describe it so as to make any one's hair stand on end. I prefer a more homely style of description, and for that reason I request the reader to think of a fire-escape, as it stands ready for action in the street; to imagine it about eight times as long and ten times as wide, and lined throughout with rotten bath-brick instead of canvas; and

he will have a very fair notion of the sort of thing the *cheminée* was, up which we had now to clamber. As to danger, of course it was not the kind of place where it would have been advisable for any one to lose his head or his feet or his presence of mind; and very likely, as seen from below, our attitudes, consisting mainly of legs like a Manx halfpenny, would have impressed a spectator with a notion of our insecurity: nor is a glacier a thousand feet below you a pleasant object, when seen topsy-turvy between your own knees. But the fact is, the work was a great deal too hard to allow us to think much about the appearance of things. For my own part, I must confess to one sensation, which for a moment gave me "a turn"—to use a slang expression. Once, on looking up to see what progress we were making, I perceived an extraordinary appearance in the sky over head. It seemed as if the whole air had suddenly become phosphorescent, or was filled with sparks dancing and wheeling about in a bewildering manner. I had read so many horrible stories about the strange effects of rarefied air upon the human subject at high altitudes that I began to feel rather nervous. What if this apparition should be a premonitory symptom! Here was a nice place to be taken with apoplexy or catalepsy or bleeding at the ears, or any other of those awful seizures we, at least, *read of*. As soon as I had a hand to spare, I rubbed my eyes to try and dispel the illusion, and in so doing discovered the cause of it. As may be supposed, we kicked up a tremendous dust in our ascent. This dust was mainly composed of minute glittering scales of mica, which from their extreme lightness remained suspended in the air, and gave it this luminous appearance. In fact, from the same cause our coats and wide-awake hats were quite shiny for days afterwards. After Ambroise and I had made a little progress, we found the others

were not following; and, absurdly fancying that they were going up some other way, we pushed on, determined not to be left behind. At length, as we paused for breath, there came a sound from below as of persons using unparliamentary language, and requesting to be informed whether or not we wanted to murder them. The state of the case was this:—our friend, who had joined us at Aosta, found himself seized with giddiness, upon hearing which the second *garde-chasse*, with undisguised glee, volunteered to stay and keep him company,—a duty which he performed by lying down and going to sleep the moment they were left alone. The others, seeing the work they had before them, put the rope into requisition and got into harness. All this was done on a little platform to one side of the entrance to the couloir in which we were, so that we knew nothing of it, and from the noise of the wind roaring down the gully could not at first hear the shouts they sent after us. Good reason, too, they had to shout, for at every step we dislodged lumps of rock which, after a mad bound or two, shot out of the mouth of the couloir like thirteen-inch shells from a mortar, whizzing past the noses of the party on the platform round the corner, and going down with a crash on the glacier below. Of course, as soon as matters were explained, we held on tight until they joined us, and then crawled up in company. There was one more difficulty in store for us. The top of the *cheminée* was blocked up by a mass of rock, with a face so perfectly smooth that it seemed likely to prove an effectual stoppage. However, Cachat being, as I have reason to believe he is, gifted with suckers, like a fly's, to all his extremities, and with a power of walking up anything, managed, after a series of contortions, more like swimming than anything else, to lay himself out on the top of it, and, with such an imitation of a

sailor's "Yeo heave ho" as could be expected from a Chamounix man, he landed us, one by one, at his feet, much as a small boy lands gudgeon out of the Serpentine. In this ignominious way we got over the last difficulty of our ascent of the Grivola. For, after a short scramble of a few yards, we were all sitting on a knife-edge of rock, with one leg hanging over Cogne, and the other dangling over the Val Savaranche.

The spot we had reached was about the middle of the square top we had seen from below, which now turned out to be a ridge some fifty yards from end to end, and so sharp that we could, and indeed, to be at all comfortable, were obliged, to sit astride upon it. Out of this there cropped up three or four spikes of rock about nine or ten feet in height, so that, in point of fact, the top looked very like a gigantic fossil jaw-bone, with a few worn old tusks still sticking up out of it. By right, and according to all the recognised rules of mountaineering, we ought to have explored this ridge from end to end, ascertained which of these spikes was the true *summum culmen* of the Grivola, and, in case of doubt, mounted them all, before giving a loose rein, as we shamefully did, to mere sensual indulgence in scenery and refreshment. The fact is, our sense of enjoyment was at the time too lively for a due observance of the niceties of Alpine climbing. We had done all that we wanted to do. We had had a noble excursion; we had settled the question about the mountain; and we had reached what was the top for all practical purposes: for the notion of any one enjoying himself on the point of one of those pinnacles was preposterous. On the whole, it seemed to strike every one as a childish proceeding to waste the precious minutes in scrambling about the ridge for the sole purpose of elevating ourselves a bare dozen feet higher, as if we had come up simply for the

sake of saying we had come up; and this when the day was already far spent, and some of the most glorious scenery in the world was waiting for us, not to speak of our friend, who was also waiting for us, half fried, half frozen, on the rocks below.* I ought, I own, to speak of our anxiety for the picturesque with some qualification, for I remember the first thing we did on reaching the top was—with shame and sorrow I confess it—not to utter any appropriate note of admiration, nor to give vent to any poetic sentiment befitting the occasion, nor yet to grasp each other's hands, awed into silence by the majesty of the scene,—a ceremony which, I believe, in practice is but rarely performed;—it was simply to raise a lusty chorus, the burden of which was “something to drink.” Alas! it was discovered we had brought up only one wretched bottle of red wine; indeed I may say of red-hot wine, for, having been slung on a guide's back for a couple of hours, it had had the full benefit of a strong sun, and was in a fine wholesome state for being swallowed by persons in our over-heated condition. One bottle of wine among five thirsty men does not last long, so we were soon at liberty to study the panorama before us. To describe this in a

* I now believe it was much more childish not to do the thing completely when we were about it. As we were descending, the *garde-chasse* above mentioned said, it would never do to come down without leaving a flag (in sober language, a bit of calico on a stick) in testimony of our ascent. The proposition was too innocent to be objected to; but when we found he was making for a part of the ridge where we had never been, it struck us both as not being an altogether honest proceeding, and we proposed returning for the purpose of giving due effect to the solemnity by the presence of the whole party. Cachat, however, pooh-pooh'd the idea; and as his word was always law with us on these expeditions, the matter was let drop. Our standard-bearer, therefore, claims the honour of having been the only man who reached the actual *point culminant* of the Grivola,—an honour to which, I think, he is fully entitled, and to which, speaking for Self and Co., I am sure he is quite welcome. I merely mention these facts as a hint for future mountain explorers who set any value on a literal fulfilment of their undertaking.

way that would convey anything beyond an idea of confused grandeur to any one who does not know the Alps would be impossible. Those who are familiar with the leading features of the great Pennine chain, will be able to imagine some of its glories when they see the position of the Grivola on the map. Placed as we were, we had to the north an uninterrupted view of the whole range, sweeping round in a magnificent curve from Mont Blanc on the left to Monte Rosa on the right. From the height at which we were, the eye could penetrate the mysteries of the great snow-deserts from which the glittering peaks and domes before us rose, and from which countless glaciers streamed down into the valleys beneath. Even Mont Blanc, though still nearly 3,000 feet above us seemed to stand almost face to face with us. From no other point of view that I know of can the claims of the two great rival mountains of the Alps be so fairly examined as from here. Seen from such an elevation as this, it is not because of his extra 500 feet of altitude that Mont Blanc is the monarch of mountains: his diadem is not "a diadem of snow;" it is an iron circlet of black precipices, above which his tall white brow towers royally, and he looks, "ay, every inch a king."

The next most striking object, perhaps, was that noble group of peaks formed by the sharp spear of the Dent Blanche, the graceful Weisshorn, and the grand old Matterhorn, with a long thin pennon of fleecy cloud flying at the maintop, like a flag of defiance,—a challenge of "Wha dare meddle wi' me?" To the west we had in full view the great snow-fields and glaciers of the Rutor, and the district of the Tarentaise, bristling with unexplored peaks. Southwards and eastwards a thin blue haze hung over the distant plains of Italy, shutting out from our view Turin and most likely the Mediterranean; but to this loss we were, to

some extent, reconciled, by having the more time to contemplate the noble mass of the Grand Paradis, then an untrodden mountain, but since ascended by Mr. Cowell. By no means the least striking part of the panorama was that which met the eye on glancing downwards. So abruptly does the peak drop from crown to base on its south side, that, as we sat astride on our rough mountain horse, we seemed almost to ride in mid air; and after our own boots, the next object the eye fell on was the glacier a thousand feet below. A gleam of green far down among the rocks showed where the valley of Cogne lay, and beyond this rose the Becca di Nona, which looks so lordly from Aosta, but from our elevation of 13,000 feet was dwarfed into a mole-hill.

It was not exactly a place to sleep in — though admirably adapted for lazy dreaming — and at last we had to go. Our unfortunate but unavoidable delay on the moraine had made us much later than we had expected to be. For the satisfaction of future mountain climbers, it may be mentioned that the ugly couloir was found quite easy, the fact being, I suspect, that we knew we had come up it, and that we must positively go down it. We rejoined our friends below, lowered ourselves over the rocks, glissaded or tumbled, according to taste, over the snow, unearthed our *cache* of provisions on the moraine, dined, and finally reached the Marmot's at about 7. Here we indulged in a bath in the trough attached to the village pump, — at least, in as much of a bath as was consistent with propriety, — for the bulk of the population turned out to witness the operation, evidently regarding it as a religious rite of some sort, — a quotidian baptism, — or else a thanksgiving for not having broken our necks. Then to supper, and then to bed; and may the present reader sleep as sound to-night as did the present writer on that 23rd of August, 1859!

4. THE ALPS OF THE TARENDAISE.

NARRATIVE OF EXPLORATIONS IN 1859 AND 1860.

By WM. MATHEWS, JUN., M.A.

INTRODUCTORY REMARKS.

IMMEDIATELY to the S. of Mont Blanc, where the crest of the great Alpine chain which encircles northern Italy bends nearly at right angles, and sweeps towards the Mediterranean, lies the group of lofty mountains known as the Graian Alps. They extend southwards from the Col de la Seigne as far as the Levanna, the first peak of the Cottians, while from W. to E. they reach from the junction of the Arc and Isère at Chamousset in Savoy to the plain of Piedmont at Ivrea.

In subdividing this important cluster of mountains, we at once encounter a difficulty which meets us in every attempt to classify the component elements of the alpine chain. Political and ethnographical divisions generally follow mountain ridges and inclose valleys, whereas the only rational method of grouping mountains physically, is to take valleys as the boundary lines. In the present instance nothing would be easier than to divide the Graians into two halves, by the crest of the main chain, which connects the Col de la Seigne with the Levanna, and separates Italy from Savoy. But then the question immediately arises, what is to be done with the peaks which lie along the line of watershed? and as no satisfactory

answer can be given to it, some other method must evidently be pursued. I propose to adopt the following subordinate groups :—

I. *The Central Graians*.—This group consists of the range between the Col de la Seigne and the Levanna. Its summit ridge is a portion of the watershed which separates Savoy from Italy, and the drainage of the Rhone from that of the Po. It is bounded by the Val de Tignes, the Val d'Aosta above Villeneuve, and the Val Savaranche. Its eastern flanks are in Piedmont, and its western in the Tarentaise, a province of Savoy, which is occupied by the basin of the *Haute Isère* and its numerous tributary valleys.

II. *The Western Graians*.—These lie to the west of the former, between the Isère and the Arc. They are entirely in Savoy, about three-fourths of their area belonging to the Tarentaise, and the remainder to the Maurienne.

III. *The Eastern Graians or Mountains of Cogne*.—This noble cluster of peaks, of which the Grand Paradis and the Grivola are the culminating points, is situated to the east of group I, and to the south of the city of Aosta. It is inclosed by the Val Savaranche, Val d'Aosta, and Val di Locana, and is entirely in Piedmont.

Few parts of the Alps can boast more conspicuous and attractive mountains than those of the Graian chain. Seen from every one of the numberless points of view between Mont Blanc and Monte Rosa, they form a magnificent feature in the southern panorama; and they lie close to two main lines of communication from France to Italy, by the Mont Cenis and the Little St. Bernard. It is nevertheless scarcely too much to say, that up to a very recent period their physical geography was as little known as that of the interior of Africa, although the district has been elaborately mapped by the Sardinian Government, and although many of its principal peaks may be seen almost within a stone's throw from the roof of the observatory at Turin. Within the last five years, however,

the Graians have claimed a share of the attention of alpine explorers, and I may mention the names of M. le Chanoine Carrel of Aosta, M. Chamonin the curé of Cogne, the Rev. S. W. King, and Messrs. Tuckett, Ormsby, and Cowell, as especially deserving of honourable mention for their discoveries in the eastern division of the chain. The central and western sections have been far less investigated, and I therefore venture to introduce them to public notice, under the general title of the *Alps of the Tarentaise*.

AUTHORITIES FOR THE GEOGRAPHY OF THE DISTRICT.

As it will be necessary to make frequent references to works bearing upon the subject of this paper, it will be convenient to give a short summary of the more important maps and other geographical publications, in which the Graian Alps have been delineated or described, particularly as many of them are very imperfectly known to English readers.

During the time that Savoy and Northern Italy formed part of the French empire under Napoleon, a trigonometrical survey was made of both those countries, and a network of triangles was determined, which extended on each side nearly to the foot of the Alps. The triangulation of North Italy was the joint work of French and Italian Geographical Engineers, while that of Savoy was executed entirely by the former. Among the officers attached to the French staff was M. Corabœuf, who probably had the direction of a considerable portion of the work, and availed himself of the opportunity to determine trigonometrically the height of several important peaks. The results of his admeasurements were communicated to the Société de Géographie de Paris, and have been printed in the "Recueil de Voyages et de Mémoires," published by that body, tome deuxième, Paris, 1825. For reasons which will shortly appear, I had long been desirous of obtaining access to M. Corabœuf's memoir, and have recently done so through the kindness of my friend Mr. F. E. Blackstone of the British Museum, who fortunately discovered the "Recueil" in

the Museum Library. The paper in question will be found in vol. ii. p. 32 and is entitled,—

“ Notice sur une Mesure Géométrique de la Hauteur au-dessus de la Mer de quelques Sommités des Alpes, par M. Corabœuf, Chef d'Escadron au Corps Royal des Ingénieurs Géographes.”

To this title is appended the following foot note : —

“ Cette notice a été rédigée et communiquée, à la Société de Géographie long-temps avant la publication de l'ouvrage du Baron von Welden sur le Mont Rosa.” *

M. Corabœuf commences by saying :

“ Les opérations géodésiques auxquelles j'ai coopéré dans la Savoie en 1803 et 1804, et en Italie pendant les années 1806, 1809, et 1811, m'ont donné les moyens de déterminer avec une précision suffisante la hauteur de quelques sommités remarquables des Alpes, telles que le Mont Blanc, le Mont Rose, et le Mont Viso.”

The paper is a very short one, and consists merely of a diagram of the triangles of the first order in Savoy and Italy, with tables of the magnitudes of their component sides and angles, followed by calculations of the heights of the various summits. Those connected with the triangles of Savoy, are the Buet, Mont Blanc, “l'Aiguille de la Sassièrre” and “l'Aiguille de la Vanoise,” and with the triangles of Italy, Monte Rosa, “Mont Iseran” and Monte Viso. Of these mountains we are here concerned with three only ; of the heights of which M. Corabœuf has made the following determinations :

Mont Iseran . . .	4045 metres	= 13,271 English feet.
Aiguille de la Vanoise	3863 „	= 12,674 „
Aiguille de la Sassièrre	3763 „	= 12,346 „

It thus appears that although these results were not published until 1825, the observations were made not later than 1811, and they must therefore be considered as the earliest contributions to our knowledge of the Graian Alps.

The first map in which the district is delineated with any pretension to accuracy, is that of Raymond, published in Paris in 1820. It is entitled —

“ Carte Topographique Militaire des Alpes, comprenant le

* Von Welden's work was published in Vienna in 1824.

Piémont, la Savoye, le Comté de Nice, le Vallais, le Duché de Gènes et le Milanais, et Partie des États limitrophes. Dressée à l'Echelle d'un mètre pour 200,000 mètres, par J. B. S. Raymond, Capitaine au Corps Royal des Ingénieurs Géographes Militaires."

In this map the Graians are shown nearly as correctly as in any subsequent production, and it probably embodies the results of the previously described triangulations.

Of the network of triangles which had been constructed in Italy, a considerable portion extended along the Parallel of Latitude of 45° , from Fiume on the Adriatic, to Rivoli near Turin, and when the Italian work was finished, in 1811, the French Government directed the measurement of another arc of the same parallel, from the coast line near Bordeaux, to the frontiers of Savoy. This triangulation was completed in 1818, and Savoy having then been restored to its ancient owners, it was proposed by the French to the Sardinian Government, in the year 1820, that the latter should undertake a triangulation across the chain of Alps, and thus unite the two arcs of the parallel. Upon this the Austrians, who had pushed their survey across Croatia and Slavonia, as far as Orsova in the Banat, volunteered their co-operation, and on the 27th of July, 1821, a convocation was signed at Turin, between the Sardinian and Austrian Governments, in virtue of which, a mixed commission, consisting of officers of the engineering staffs of the two nations, with the addition of M. Plana of Turin and M. Carlini of Milan, as astronomers, was appointed to undertake the work. The enterprise was prosecuted with vigour, the field-work was completed in 1823, and the triangles connected with the French System by Colonel Brousseau and M. Nicolle. In 1824 the commission met in Milan to prepare their materials for the press, and in 1825 the results were given to the world in the publication entitled —

"Opérations Géodésiques et Astronomiques pour la Mesure d'un Arc du Parallèle moyen, exécutées en Piémont et en Savoie, par une Commission composée d'Officiers de l'État Major Général et d'Astronomes Piémontais et Autrichiens, en 1821, 1822, 1823. À Milan, de l'Imprimerie Impériale et Royale. 1825."

This important work consists of two quarto volumes of text, and an atlas, and gives a full account of the labours of the commission, with a record of all their observations. The chain of

triangles was constructed a little to the north of the parallel; it extended from Turin, over the Cenis, to Mont Colombier beyond Chambéry, and contained eighteen angular points, of which the larger number were upon a series of peaks on either side of the valley of Susa, and of the Maurienne.

The triangulation is laid down upon an excellent map, on a scale of $\frac{1}{500,000}$ comprising the whole of the Graian Alps; and there are also 16 smaller maps, on a scale of $\frac{1}{100,000}$, of the immediate vicinity of each of the trigonometrical stations, four of which belong to the Tarentaise. The Atlas also contains six panoramic views, engraved from drawings made by the camera lucida, from the stations which commanded the widest horizon. The maps just described, particularly those upon the larger scale, are deserving of the highest commendation, and far exceed in accuracy any other work which has been issued under the auspices of the Sardinian Government.

The next publications which have to be mentioned are the Government maps of Piedmont and Savoy. Of these the first is that usually known as the Six-Sheet Sardinian map, the "*Carta degli Stati di sua Maestà Sarda in Terraferma, Opera del Real Corpo di Stato Maggiore generale, incisa e pubblicata l'anno 1841.*" Its scale is $\frac{1}{250,000}$, and it professes to be an exact reduction from a larger map of the Real Corpo in 96 sheets, on a scale of $\frac{1}{50,000}$. It has probably been improved from time to time, as one of the sheets of a copy in the possession of my friend Mr. Tuckett contains a table of the population in 1846, and on another is a note to the effect that it was reproduced by electrotype in 1859.

The large map on the scale of $\frac{1}{50,000}$, now in course of publication, cannot be the same as the one just referred to, inasmuch as the key to it shows only 91 sheets instead of 96, and as sheet 37 bears upon it the following memorandum:—"Riconosciuto sul terreno nell'anno 1853, pubblicato nell'anno 1858." It is by far the most elaborate and pretentious map of the Sardinian territory hitherto produced, and it contains the whole of the Graians except the lower part of the Val de Tignes, included in sheet 29, which is not yet published.

There is also another Government map on a scale of $\frac{1}{150,000}$, not, I believe, sold to the public, and of which I do not know the date. I am indebted to the Rev. S. W. King for the loan of one of the sheets, but there is nothing in it which calls for remark.

In each of the three maps here described the Alpine portions are most inaccurate and unsatisfactory.

In 1845 appeared a portion of a work entitled "*Le Alpi che cingono l'Italia, considerate militarmente.*" It was to have consisted of five parts; the first geographical and descriptive,—the second, third, and fourth, historical, with particular reference to battles,—and the fifth to contain a map and plates explanatory of the geographical section. The first and fifth parts are the only ones in my possession, the others I believe have never been published. The work appears to have been edited or written by Count Annibale di Saluzzo (whose name is appended to the dedication to Charles Albert), from materials collected by the *Real corpo di Stato Maggiore*. Part I. consists of an account of the whole Alpine chain, from the Mediterranean to the Adriatic, under several tables, called "*Quadri.*" The first quadro contains a description of the minerals in the Alps,—the second, of the woods and forests,—the third, of the roads,—the fourth, of the valleys,—the fifth, of the lakes,—and the sixth, of the canals. But what is more interesting, the seventh quadro is a very extensive table of heights, including the latitude and longitude of the points measured, the name of the authority, and the method of determination. The fifth part of the work comprises a map upon a scale of $\frac{1}{600,000}$ of the whole chain described in Part I., and some panoramic profiles of no great interest. In the list of heights the determinations of Corabœuf, quoted previously, are ascribed to "*Ingegneri Francesi,*" and both the Pic de Grivola and Grand Paradis are omitted, although the latter is mentioned in another part of the book.

METHOD EMPLOYED IN MEASURING HEIGHTS.

I visited the Tarentaise in 1859, 1860, and 1861, having with me on the first occasion a sympiesometer, by Adie, which proved perfectly useless. The glycerine column, in falling, always separated into numerous portions, with wide gaps between, so that it was impossible to determine its length. In 1860 and 1861, I carried one of Casella's mountain barometers, on Fortin's principle, with an ivory point, and I have great pleasure in bearing testimony to the excellence of the instrument. In the former year, indeed, the tube was broken during my homeward journey,

but in 1861 it was carried about the mountains for several weeks without the smallest mishap.

The mercurial barometer is by far the most trustworthy instrument for hypsometrical purposes, most others being merely indirect contrivances for ascertaining the atmospheric pressure in height of mercurial column. From its length, it is at first rather awkward to carry, but one very soon gets used to it, and every mountaineer, travelling in an unexplored district, should make it his constant companion. In using it for the measurement of heights, it is necessary to select beforehand the stations for comparison, in order that the observations may be made as nearly as possible simultaneously with those at the lower level. For the Graian Alps, the observatory at Geneva, the St. Bernard Hospice, and the Turin Academy are the best bases, and to these may be added Aosta, where the barometer is observed daily by M. Carrel. At the Turin Academy, the meteorological observations are made at 9 A.M., noon, and 3 P.M., and the same hours are adopted by M. Carrel. At Geneva and St. Bernard the records are far more complete, the instruments being read every even hour, from 6 in the morning until 10 at night. It may be useful to add, that the heights above the sea of barometer cisterns at Turin, Geneva, and St. Bernard, are 284, 408, and 2478·3 metres respectively.

The next step to be taken is to compare the mountain barometer with the fixed instruments at the lower stations, in order to ascertain the differences in their index errors. In 1860 I neglected to do this at the commencement of the journey, and the comparison was made at Turin after I had left the Alps. On August 23rd my barometer stood 1·5 millimètres lower than the Academy instrument, a discrepancy much greater than it ought to have been. In 1861 I took the precaution of making a comparison at Geneva, before the barometer was subjected to the rough usage of the mountains. The instrument and its attached thermometer are graduated both in French and English measures, and the two scales have not necessarily the same index error. On August 3rd, by a mean of two comparisons it stood ·49 mm. and ·027 inches below the observatory standard. On the 27th it was compared at Turin, when the mean of three comparisons gave a depression of 1·46 mm. and ·06 inches below the Academy instrument, a difference nearly identical with that of the previous year. On a final comparison with Mr. Casella's standard made on my

return to London, it was found that the error had increased $\cdot 74$ mm. and $\cdot 029$ inches during the alpine journey. This was annoying, as it invalidates the results to a certain extent; the alteration in the error was perhaps due to the great fluctuations in the length of the column causing the unboiled mercury in the cistern to mix with the boiled mercury in the tube, and so carrying up a minute quantity of air. Previously to every observation, I tilted the tube, so that the mercury struck against the top, but I never detected any dullness in the click. It thus appears desirable to make comparisons not only at the beginning and end of a journey, but at intermediate times, and as frequently as possible. The increase in the index error will not account for the whole discrepancy at Turin, and it is probable that the indications of the Academy barometer are somewhat too high. The barometer at St. Bernard is kept constantly *en rapport* with that at Geneva, so that any mountaineer who has compared his instrument at the latter place can avail himself of the St. Bernard observations. The Index errors here described are not included in the barometer readings, as given in this paper, but have been added to them before making the calculations.

Throughout the journeys of 1860 and 1861 I invariably read the barometer and attached thermometer in duplicate, making the record both in French and English measures, and reducing the height of the column to the freezing point independently in the two scales. By comparing the results, any error in the original reading or in the process of reduction could at once be detected. The air temperature was taken by one of Mr. Casella's centigrade thermometers, tied on to the shady side of an alpenstock about five feet above the ground. The altitudes were calculated by tables based on La Place's formula, which contains corrections for temperature, latitude, and decrease of gravity in a vertical line. The tables employed, which are the best and simplest for the purpose, are those of Delcros in French measures, and of Guyot in English; they will be found in the "Physical and Meteorological Tables" of the Smithsonian Institute of Washington, edited by Guyot, an admirable work, the most complete collection of meteorological information that has ever issued from the press. In 1860 I made the calculations in French measures only, but in 1861 both in French and English, taking the mean of the results, and going through the figures a second time whenever the difference was great enough to indicate the probability of an arithmetical

error. In 1861, when comparisons were made with the three bases of Turin, Geneva, and St. Bernard, each observation thus involved six distinct sets of calculations.

I gladly avail myself of this opportunity of acknowledging my obligations to Signor Cantu of the Turin Academy, and to M. Plantamour, Professor of Astronomy at Geneva. I am deeply indebted to both these gentlemen, not only for the facilities they afforded me for the comparison of my barometer, but also for their kindness in furnishing me with the necessary extracts from their meteorological registers. I have also to thank M. Plantamour for his valuable suggestion of a very simple method of extemporising a moist bulb thermometer. After taking the air temperature, nothing more is necessary than to cover the bulb of the thermometer with a small piece of paper either dipped in the nearest stream or merely moistened in the mouth. The process is so simple, that it is always worth while to include a moist bulb reading with the other observations. I have not, however, availed myself of this additional element to make use of Plantamour's tables based on Bessel's formula, which contains a correction depending upon the humidity of the air; partly because they are far more complicated than those of Delcros, and the calculations involved more time than I had at my disposal; and partly because it was necessary to compare the results with those from St. Bernard and Turin, where the moist bulb thermometer is not observed.

It will be observed that the St. Bernard results are generally lower than the others. This is not the place to enter into a discussion of the causes of this phenomenon, they are fully explained in a masterly memoir by M. Plantamour, entitled "*Mesures Hypsométriques dans les Alpes*," Genève, 1860. The difference varies with the time of year, and hour of the day, and is a maximum in the month of July, and from 12 to 2 p.m. If the observations had been made at night, the St. Bernard results would have been the highest.

NARRATIVE OF EXPLORATIONS IN 1859 AND 1860.

It was in the year 1859 that I was first enabled to indulge a long-cherished desire of forming some practical acquaintance with the Graian Alps. I had been travelling

with my brother, Mr. G. S. Mathews, and after many delightful excursions in the Bernese Oberland, and the neighbourhood of Zermatt, we arrived, towards the end of August, at Chamounix, and began to think of turning our faces homewards. A few days previously we had met Messrs. Ormsby and Bruce at Aosta, and fired by their success upon the Grivola, we resolved to conclude our mountain work by making a rapid march from Chamounix to Turin by way of the Col d'Iseran. Mont Iseran, the supposed monarch of the Graian chain, is placed by the Sardinian surveyors just on the east of the Col, and occupies a most prominent position upon sheet 37 of the large Government survey, with Corabœuf's determination of 4045 metres upon its summit. We intended to subject the peak to a thorough examination, and if it looked easy to try to climb it. Success was too doubtful to make it worth while to take on our guides; we, consequently, dismissed them, and quitting Chamounix on Tuesday the 30th, we shouldered our knapsacks, and crossed the Forclaz to St. Gervais. On the 31st the fine season of 1859 fairly broke, and was succeeded by a period of wet and cloudy weather. On the first rainy day for nearly five weeks, we walked from St. Gervais over the Col du Bonhomme to Bourg St. Maurice in the Tarentaise, where we found comfortable but rather expensive quarters at the Hotel des Voyageurs.

On Sept. 1st we left Bourg at 7.30 A.M. by the route of the Little St. Bernard, which follows the course of the Isère as far as the village of Scez. Above this place, where the road and river separate, the latter bending suddenly to the S.E., the Isère valley is called the Val de Tignes. Quitting the main road, we struck into a mule path on the right bank of the river, and in about two hours from starting reached St. Foi, situated in the midst of verdant

sloping meadows and shadowy groves of walnut. Above St. Foi is La Thuile, and then Brévières, where the valley opens out into a little plain, and then contracts and mounts again, only to widen somewhat farther on into the plain of Tignes. We arrived at this village at 1 P.M., and entered the auberge de St. Roch, *chez* Florentin Revial, just behind the church. The morning had been too cloudy for distant views, and the mist unhappily entirely obscured the mountain S.W. of St. Foi, which I was very anxious to catch sight of. It is called in Murray, the Chaffe Quarre, but its proper name is the Mont Pourri. The valley we had passed through was, nevertheless, extremely picturesque; at times the path led us through glades of pine forest, at times through pleasant meadows, flat or steeply sloping, at times through trees again, interrupted by massive crags, and with glimpses of waterfalls and glaciers.

I know few spots surrounded by such beautiful scenery as Tignes, and certainly there is none so convenient as head-quarters for the exploration of the Tarentaise. It stands on the banks of the swift Isère, on a grassy plain, about a mile long by half a mile wide; just across the river, on the E., the stream from the Lac de la Sassièrè cascades over the cliffs, and on the opposite side of the village a torrent rushes down from the Lac de Tignes, a charming sheet of water, in the very bosom of the mountains, and producing excellent trout. The Aiguille de la Sassièrè, the culminating point of the central Graians, rises above the first-named lake; many other lofty peaks are close at hand, and passes radiate from Tignes to nearly every part of the Graian Alps. Of these I may mention the Col Vaudet into the Val Grisanche; the Col de Gailletta into the Val de Rhêmes, and thence to Villeneuve and Aosta; the Col de Galèse into the Val Locana; the Cols of

Iseran, Larossor, and La Leisse into the Maurienne; the Col du Palet to Moutiers Tarentaise, and the Col de la Sache into the Val Peisey.

Decent food and lodging alone are wanting to complete the attractiveness of Tignes, and how far these are at present supplied will immediately appear. On entering the inn we were greeted by an old woman, who spoke a hideous patois, and who conducted us through the kitchen into a den behind called by a playful metaphor the *salle à manger*. In answer to our demand for dinner, she produced, after a long delay, soup composed of bad grease and vermicelli, an omelette, and an unlimited supply of *salé*. The later delicacy was winter-dried mutton, to be eaten uncooked. Those of my readers, to whom it is not familiar, may form a tolerable idea of it by cutting a rudely triangular piece out of a mahogany board, slicing it into thin shreds with a very blunt knife, and then endeavouring to eat it.

We found a peasant in the inn, and tried to get some information from him as to the time it would take us to cross the Col d'Iseran to Bonneval. He had crossed it some years before, and told us it was a six hours' journey, whereas our hostess assured us we could do it in four. Not being quite certain about the way, and having had more-over quite enough of our knapsacks in the morning, I asked her to try to find us a guide, and suggested five francs as an adequate remuneration. After an absence of half an hour, she reappeared, accompanied by a short broad-shouldered man, with scoundrel written on his countenance. The new comer informed us that it was eight hours to Bonneval, and that his terms were twenty francs, saying that the guides had to risk their lives on these mountain expeditions, and that they ought to be well paid. Knowing there was a mule path all the way, of course we demurred

to this extortionate demand, but after a long negotiation I was weak enough to agree to give him twelve. So much time had been lost by this unpleasant discussion, that it was 3.15 P.M. before we left the inn. We were so disgusted at the conduct of the guide that we resolved to punish him, and as we were both in first-rate condition, and had really not a moment to lose to save the daylight, we walked very fast. He struggled hard to keep up with us, but did not find it easy, and scarcely left off muttering imprecations all the way up to the Col. I discovered the following year that this rascal, whom our hostess had taken half an hour to find, was no other than her husband, the landlord of the inn.

Above Tignes, the valley narrows into a picturesque defile, and opens out again into the plain of Laval, where it turns sharply to the E. Laval itself, a nest of squalid habitations, is a fitting portal to the highest reach of the Isère valley, a dreary track of treeless rocks and pastures. The source of the river is at the glacier of Galèse, over which lies the pass of the same name to Ceresole. We, however, were bound to another point, and soon after leaving Laval, zigzagged up the slopes on our right, until we came in sight of a line of stone pyramids, which mark the route across the Col d'Iseran, in place of the fir poles usually employed in similar cases. These pyramids are substantial erections, with niches at the bottom large enough to hold several persons, and well adapted for shelter in bad weather. Ever since leaving Laval I had been straining my eyes in vain to catch a glimpse of the Mont Iseran, and on gaining the summit of the pass, I exclaimed to the guide: "Here is the Col, but where is the Mont Iseran?"—"C'est ici, Monsieur," was the reply. "I don't mean the Col but the great mountain," I rejoined. "*Eh bien, Monsieur, c'est ici.*" "*Mais, où est le pic de neige*

qu'on appelle le Mont Iseran ?—" *Il n'y a pas de pic de neige, Monsieur ; c'est toujours un sentier à mulet.*"

I thought at first that the guide was only stupid, although I had observed that the country people never spoke of the pass as the Col, but always as the Mont Iseran. "*Vous allez passer le Mont Iseran, Monsieur, n'est-ce pas ?*" had frequently been asked us. On looking eastward, however, towards the actual spot which the mountain occupies, according to nearly all the maps, I could see positively nothing but a line of low cliffs and overhanging glacier. Still it was quite possible that the peak might be concealed by clouds or intervening mountain ridges of lower elevation. Evening drew in rapidly as we descended towards the valley of the Arc, and it was dark when we arrived at Bonneval. It may be useful to future travellers to state the time occupied in walking from Tignes which we left at 3.15. We reached Laval at 4.15, the Col at 6, and Bonneval at 7.30. Time from Tignes to Bonneval four hours and a half, from Bourg St. Maurice to Bonneval, exclusive of halt, nine hours and three-quarters, but we walked very quickly.

Our guide led us to one of the largest buildings in the village, and on the door being opened we were admitted into what appeared to be a cowhouse. From this we passed into a large barn half full of hay, and thence into the living room of the family. Our host, on being informed that we required supper and lodging, brought us out of doors again, and conducted as by an outside flight of steps into a small upper room. We enjoined him to give us the best supper he could put upon the table, and in due time he reappeared with soup, eggs, and a dish containing apparently two roasted cricket-balls. On a closer investigation these were found to be marmots' heads, but we could discover nothing edible on the exterior,

and our first attempts to get inside were not attended with success. At length I split them open with a knife and a geological hammer, but finding no more inside than we had found outside, we handed them over to our guide, who worked away at them with immense energy and satisfaction. Our host having succeeded in discovering milk, we brewed some chocolate and so made a tolerable supper. Our sleeping apartment opened out of the barn, and contained a couple of rough but clean beds.

The existence of any Mont Iseran other than the mule-track being stoutly denied at Bonneval, and the weather continuing very unpropitious, we determined to push on at once to Turin. We started again at six on the morning of the 2nd, hoping to get a better breakfast by walking for it to Lans-le-bourg, and passing down a valley only equalled in dreariness by the upper part of the Val Isère, we arrived at 9 at Lans-le-Villard, a few hundred yards from the zigzags of the great road. Here we discovered that Lans-le-Bourg was three miles lower down, and not being anxious to add an unnecessary six miles to our day's walk, we turned at once into an inn and ordered breakfast. We found the commissariat resources of Lans-le-Villard decidedly inferior to those of Bonneval, the village being far enough from civilisation to be out of the reach of meat, and not high enough in the mountains to be supplied with milk and butter. According to Murray, the inhabitants of this place salt their donkeys for food, a practice which he says is common in the Tarentaise. As the donkeys would certainly not be put into pickle until they had reached a ripe old age, we have here an obvious explanation of the extraordinary toughness of the dried mutton presented to the traveller in these parts of the Alps. We left Lans-le-Villard at 10, walked over the Cenis to Susa, and took the train to Turin, where we

thoroughly enjoyed the comfort and luxury of the excellent Hôtel de l'Europe.

At one of the first meetings of the Alpine Club held after my return to England, I brought forward the subject of the Mont Iseran, desiring to know whether the mountain had a real or only a mythical existence. None of the members present had ever seen it, although several had travelled in the district, and one had even crossed the Col de Galèse, and looked for it in vain. It was suggested by Mr. Ball that the Aiguille de la Sassièrè had been mistaken for it, and by the Rev. S. W. King that it was the Vanoise which had been measured in its stead. One thing only appeared perfectly certain, and that was that the Graian Alps required thorough investigation.

The principal object of my Alpine wanderings in 1860 was to explore the neighbourhood of the Grand Pelvoux and Monte Viso, and to attempt the ascent of both those peaks. The Rev. T. G. Bonney and Mr. J. C. Hawkshaw having turned their thoughts in the same direction, we agreed to unite our forces, but as they could not start until the 11th of August and I wanted to leave on the 1st, I resolved to have a preliminary run in the Tarentaise, and promised to meet my friends at La Bérarde on August the 14th.

My old guide, Jean Baptiste Croz, having accepted another engagement, I secured the services of his brother Michel, whom I found to be a first-rate mountaineer, and, wishing to render myself entirely independent of the natives of the Tarentaise, I directed him to bring a porter from Chamounix, and to meet me at Moutiers on the evening of Thursday the 2nd of August. I quitted London on the morning of the preceding day, reached Paris just in time to catch the night train to Macon, and left the

Victor Emmanuel railway at Chamousset at noon on the 2nd, by the diligence for Moutiers. We entered the town at 6 P.M., and drove up to the door of the Hôtel de la Couronne, where I found Michel Croz and the porter awaiting my arrival. Thus the journey from London to the heart of the Tarentaise can be effected in thirty-five hours!

On Friday the 3rd of August I started at 5.30 A.M., intending to devote my first day among the mountains to walking up the valley of the Doron, and crossing the Col du Palet to Tignes, which I flattered myself would be an easy day's work. There is a carriage road as far as the pretty little village of Bride-les-Bains, about an hour from Moutiers, a spot of some resort as a watering-place, and containing a pension of so comfortable an appearance, that I regretted I had not pushed on here the preceding evening instead of staying at Moutiers, where the inns are but indifferent. Another hour's walk brought us to Bozel, and at 8.50 we arrived at Champagny, where the valley forks, the main branch ascending southwards by Pralognan to the mountains overhanging Modane in the Maurienne, and the other continuing in an easterly direction towards the Col du Palet. The intervening angle is occupied by a very important range of mountains, of which I shall speak presently. I was greatly charmed with the lower part of the valley of the Doron, through which I had just passed. Numbers of small enclosures with overshadowing walnuts bounded the river on either side, above them sloping meadows shot up like tongues of brilliant green among the sombre pines, which were broken again still higher up by massive juts of crag and silvery streaks of water. Owing to the inclement season, the corn in the inclosures was still green, and the flowers far more brilliant than I had ever seen them at this time of year. *Lathyrus tuberosus*, with

its elegant clusters of pink flowers, waved among the corn, and the road sides were ornamented with the deep purple bells of *Specularia speculum*. We stayed an hour at Champagny, where we lunched on eggs and uncooked ham, and, as we were all perfectly ignorant of the country, I made some inquiries about the route. We were directed to keep to the track by the river-side until we came to the "Grand Châlet," and then to bear up to the left on the northern slope of the valley to the pasturage of "*La grande Plagne, une bien grande montagne*," where they kept 300 cows. Soon after starting it began to rain heavily, and the great mountain range on our right was entirely obscured by clouds. On arriving at a point where the track forked, we concluded we were at the Grand Châlet, although no building was visible, and climbing up the rocks on the left, we landed in the thick fog on an upland grassy plain, with no path to be discerned. In this emergency I despatched Croz in the direction of some distant cow-bells to obtain information. After a long delay he returned, having ascertained the position of the col, and a brisk walk brought us up to a man and his wife, natives of these parts, who were also bound to Tignes, but who had never crossed the col before. They had, however, been already upon it, and having turned too sharply to the right, had descended the valley again by the river-side, and had arrived at the grand châlet several hours after they had quitted the same spot. As we ascended towards the col the rain turned to snow; I gathered, nevertheless, some interesting Alpine plants; on the rocks below the pastures were *Saxifraga cuneifolia*, and *Woodsia ilvensis*; a boggy flat above them was covered with a *Gagea* in full bloom, I think *G. Liottardi*; the slopes beyond produced *Saponaria ocymoides*, a lovely plant with brilliant crimson flowers; and on what I imagined was the

col itself, I found *Astragalus alpinus*, *Ranunculus pyrenæus*, and *Gregoria vitelliana*.

We arrived at the top of the col at 3.15, and held council on the route. I knew that the heads of two valleys converged on the further side,—that of the Val Peisey, which descends towards the N. and joins the Val Isère below Bourg St. Maurice, and that of the Lac de Tignes, which takes an easterly direction. Our way lying along the latter, I insisted upon keeping to the right, whereas our new acquaintances as strongly urged going to the left, saying that the way I proposed was the one they had taken in the morning, which had brought them back to their starting-point. The fog was so thick that we could see nothing, and thinking that our two companions knew more of the country than we did, we yielded to them and let them lead the way. After a descent of about two hours a temporary lull in the snow-storm revealed a lake and some cow chalets, and I sent Croz forward to confer with the berger. He soon returned with the intelligence that we were, as I suspected, in the Val Peisey, at the spot called Autre Lai, and that if we would reach our destination that night we must clamber over the mountain-ridge which divided us from the Val de Tignes. As it was now nearly 6, not a moment was to be lost, and we faced our work in earnest. The ground proving very rough, and the snow coming down with even greater energy than before, the lady and gentleman retreated, I know not whither. At last we gained the crest of the ridge at a point called the Col de la Sache, and descended into a lateral valley which joins the Val de Tignes at Brévières. Walking ankle-deep in snow, and bearing to the right as much as possible, we reached Tignes at 9, and entered the inn I had dined at the year before on my way to the Col d'Iseran. I had thus commenced Alpine

work after two days and a night of hard travelling, with a walk of fifteen hours and a half, and when we gained our quarters, I had eaten nothing for eleven hours, and was hungry, tired, and wet to the skin.

The Auberge de St. Roch had not improved since my last visit. In consequence of the annexation of Savoy to France, the frontier line now ran along the mountain-ridge on the E. of the Val de Tignes, and fourteen Sardinian and two French douaniers were quartered in the valley, ready to pounce upon unwary travellers. There were but two spare bed-rooms in the house, one entered through the other, and the two French douaniers had engaged the inner one. The outer room contained three beds; one was occupied by a Sardinian douanier, I took possession of the second, and Croz and the porter of the third. Our supper consisted of vermicelli soup, and an omelette, which was followed by vermicelli plain boiled. The wine was very fair, as indeed it is generally throughout the Tarentaise; it is grown in the neighbourhood of Montmeillan. I was so thoroughly knocked up, that, notwithstanding my long fast, I could eat no supper; so I drank a couple of glasses of wine, and went off to bed.

Saturday was cloudy, with rain at intervals, so that it was impossible to put in hand any serious work, and I was not sorry to have a day's rest. At 11.20 A.M., I read the barometer; the height deduced from a comparison with Turin is 5405 feet, while the Schlagintweits give 5426 feet for the level of the Isère.*

I spent the afternoon in strolling up to the Lac de Tignes, an hour's walk from the village. There was far too much cloud for distant views, but the scene was charming, notwithstanding. The water is as clear as crystal, and the

* "Neue Untersuchungen über die Alpen," p. 65.

lake is surrounded by wide pastures covered with beautiful flowers. A man had been drowned in it the day before; having been seized with a fit while fishing, he overturned the boat in which he was sitting, and sank immediately. The body had not been recovered, although I was told it could be clearly seen at the bottom. I made the tour of the lake, and examined the remarkable mountain of gypsum, marked Tuf de la Thouvière on the large Government map; it is crowned by a mass of tufa like breccia, and deeply furrowed by watercourses. Heavy rain coming on again, we were driven back to the inn. Our dinner was an exact counterpart of the previous evening's supper; indeed, the only way in which a meal can be varied at Tignes is by differences in the cooking of the eggs. They may be taken as omelettes, fried, boiled, or eaten "*comme ça*," which is French for raw, in the Tarentaise. We were promised a better dinner on the morrow, as a sheep had just been killed in honour of the Sunday, and we gave strict injunctions for a part of it to be cooked that night, in order that we might have meat to take with us in the event of the morning being fine enough for an excursion. My intention was to make the ascent of the Sassièrè my first expedition, and to see if I could discover the Mont Iseran from its summit.

It was 5.30 on the morning of the 5th of August before I awoke, and on looking out the sky gave promise of a brilliant day. In Alpine travel, to seize upon fine weather the instant it presents itself, is the first condition of success, and a single sunshiny day not turned to account may bring a whole journey to disaster. I roused my guides, gave the order for an attack upon the Sassièrè, and bade them make the necessary preparations with all practicable despatch. I was nearly driven mad by the miserable imbecility and inertness of the people in

the inn. It was an hour before we could get breakfast; and it then appeared that they had cooked no meat the night before, so that there would be another long detention before the provision knapsack could be packed. At 7.20, I started off with the porter, telling Croz to stay behind to see to the provisions, and to follow us as fast as possible.

Crossing the Isère close to the village, we began to mount immediately on the southern side of the cascade, and on gaining the summit of the cliff, we passed by a wooden bridge across the torrent, where it thunders at the bottom of a narrow gorge. We had now before us an upland valley, with the Sassièrè on our left hand, and on our right the ridge dividing us from the upper reach of the Val de Tignes above Laval. In the centre of the valley, surrounded by a pleasant pasture, lay the Lac de la Sassièrè, fed by glacier streams, and beyond it was a great glacier, over which is the pass of the Col de Gailletta into the Val de Rhêmes. The Sassièrè itself as seen from this position is a very steep escarpment of rock, standing E. and W., and composed of schistose beds, stratified nearly horizontally, and showing their edges along the face of the escarpment. It is crowned by a thick cornice of snow, which rises into a dome at the further extremity, so that the mountain cannot with any approach to accuracy be termed an *aiguille*. It is supported on the side of Tignes by a huge buttress of rock, rising immediately from the Isère, the upper part of which is connected with the cornice by a steep *arête* of snow. Turning in the opposite direction to the col, we looked across the Lac de Tignes to a snow-peak of most graceful contour, which has been by some mis-called the Aiguille de la Vanoise; it is really a mountain rising from the Col de la Leisse, immediately on the W. of that pass, and is named on the large Government map

the Aiguille de la Grande Motte. Considerably to the right of it was the massive frame of the Mont Pourri, terminated by two peaks, of which that on the left overhanging the Col de la Sache, which we had crossed from the Val Peisey, appeared scarcely less elevated than the other. This, however, was a deceptive effect of perspective, the northern, or right hand peak, which was much more distant, being about a thousand feet higher. Rocks and flowers and mountain streams sparkled in the sunshine, and the sky was one unbroken vault of glorious Alpine blue, except where bonnet clouds rested on the summit of the Sassièrè, and upon the peaks of the Mont Pourri. These were elegant white wreaths, which, in their upper outlines, followed the curvature of the mountain brow, and on their under side faded away gradually before they actually touched it.

After examining the face of the Sassièrè, we at first decided on ascending to the Col de Gailletta and then scaling the final peak which appeared close to it, an error from which we were happily saved by a conference with a herdsman, who induced us to select the summit of the western buttress, or rather a notch in the ridge to its right, as our first point of attack. This we reached without difficulty, and found ourselves at the bottom of the snow arête which divides the valley out of which we had ascended from another leading down to Brévières. On gaining the top we landed on the cornice, the southern termination of a gently sloping surface of snow, which has an outlet towards the S. in the Val de Tignes. We walked as close to the edge of the cornice as we could without risk of falling through, zigzagged up the final dome, and reached the summit at 1.15 P.M., after a walk of six hours all but five minutes, including a halt of half an hour for refreshment. An indisputable proof that we were not the first

arrival immediately presented itself. A few feet below the summit, on the side of Tignes, where the stony skeleton of the mountain just peered through the snow, were the relics of an ancient cairn, with boards and fragments of pine-wood sticking up in wild disorder. My disappointment at having been anticipated in the ascent was somewhat appeased by the means thus afforded of fixing a minimum thermometer, which would not otherwise have been possible. Having set up the barometer and left it for the mercury to become steady, I proceeded to examine the different parts of the wonderful panorama that lay stretched out around us.

We are standing in the centre of the Graian Alps, almost every peak of which is visible, while beyond them, on the one side, are the savage ramparts of the Pelvoux, and on the other the Pennine chain from Mont Blanc to Monte Rosa. The latter range is of course the most prominent feature in the prospect. Let us look at it a little more in detail. The mass of Mont Blanc appears to commence with a very steep and narrow aiguille, which Croz says is just above Mottet; it is probably the Aiguille du Glacier; to the right of this are the Aiguilles of Miage and of Bionnassay, the Dome and the Calotte, and then the well-known form of the Aiguille du Géant beautifully sharp and distinct; the Aiguille Verte and other peaks beyond it are crowded and confused; I am unable certainly to decipher them. To the right of the break in the chain, where lie the Col Ferret and the Great St. Bernard, are my old friends the Vêlan and the Combin, succeeded by the Dent Blanche, the Dent d'Erin, and the Matterhorn, and those again by the Breithorn, the Lyskamm, and the many-peaked ridge of Monte Rosa. In examining the Graians, I first look to the westward down upon the Lac de Tignes; beyond it are two high moun-

tains, one the Grande Motte, snow-coated from base to summit, the other to the right of it, and far higher, presenting a nearly vertical wall of rock, crowned by two peaks, and overhanging the valley above Champagny, along which we had walked towards the Col du Palet. Turning a little to the right we have before us the striking mass of the Mont Pourri, rising nearly opposite to us beyond the Val de Tignes, down which we can look almost to Bourg St. Maurice. Due N. extends the ridge which divides Piedmont from the Tarentaise, and connects the Sassièrè with the little St. Bernard and Col de la Seigne; it is broken into many peaks, with intervening glaciers, but there is no part of it which is not hundreds of feet below our position. On the side of Piedmont we look along the valleys of Grisanche and Rhêmes into the Val d'Aoste, and across the Val Savaranche to an enormous chain of rock, culminating at its two extremities in the black peak of the Grivola and the snow-topped Grand Paradis, S. of which is the comparatively insignificant Levanna. We now look southwards, where we ought to see at a distance of only eight miles the mighty peak of the Iseran, upwards of 13,000 feet in height; but nothing of the sort is visible. I am unable indeed to make out the exact position of the col of the same name, owing partly to the village of Laval and the valley above it being hidden by intervening mountains, and partly to the large tracts of unmelted snow, which were not in existence when I crossed to Bonneval the previous year, and which make it difficult to distinguish between mere snow-covered slopes and glaciers. There is, however, in view one excellent landmark, the Lac d'Ouglietta, situated in an upland plain just S. of Laval. A glance at sheet 37 of the Large Survey will show that a line drawn from this lake to the Levanna, passes straight through the summit of Mont Iseran, whereas I can detect

no peak of the smallest importance between these two points.

Having carefully noted the form and position of the surrounding mountains, the next proceeding was to compare their heights with that of the Sassièrè, and a pocket-level was mounted for this purpose. We were of course overtopped by most of the peaks of the Pennine chain, and by some of those of the Pelvoux. Four only of the Graians lifted their heads above us, two in Piedmont, and two in the Tarentaise. The former were the Pic de Grivola and the Grand Paradis, both of which appeared considerably higher than the Sassièrè. Some of the Graians of Cogne may also be more elevated, but, being intercepted by the Paradis, were not included in our range of view. The two peaks of the Tarentaise were the dark mountain beyond the Lac de Tignes, and the Mont Pourri, apparently nearly the same height, and at most three or four hundred feet above us. The height of the Mont Pourri was a great surprise; I had no idea that it was so lofty a mountain.

At 2.30 P.M. I observed the barometer, and the readings were as under:—

Barometer reduced	483.06 mill.
Air temperature	—1.0 Cent.

A comparison with the observation at Turin at 3 P.M. on the same day gives an altitude of 12,306 feet, that determined by Corabœuf being 12,346, 40 feet greater.

During the whole time we were upon the summit there was a very high wind, which blew from every point of the compass in succession, and which vitiated an observation for solar radiation, which I attempted to make with a black bulb thermometer.

The only duty now remaining to be performed was to

fix a minimum thermometer. Selecting the strongest board from the ruins of the signal, we placed it with its breadth vertical and length horizontal on the site of the old cairn, and fixed it firmly with large pieces of rock, so that its face was directly opposite to the Lac de Tignes. Having carefully adjusted the index of the minimum marked A C, No. 302, which stood exactly at zero, I hung the instrument on two copper nails I had driven into the board, and well secured it with brass wire.

Having spent two hours of supreme enjoyment, notwithstanding a high wind and a thermometer at freezing, it was time to think of returning, and at 3.15 we left the summit. At 4 we reached the base of the arête where it unites with the great buttress, and this being a very sunny position, with plentiful supplies of snow and water, we reclined upon the rocks and turned our attention to dinner. Another hour soon sped away in the agreeable process of restoring exhausted nature and lazily looking at the sky and mountains, and it was 5 before we resumed the descent. Some alluring snow-slopes on our right tempted me to try a new route to Tignes by the valley leading to Brévières, and five or six delightful glissades in quick succession soon landed us upon the pastures. Thence bearing well to the left we gained the face of the buttress overlooking the plain of Tignes, and, cautioning the porter to follow quietly for fear of injury to the barometer which he was carrying, I raced Croz down the slopes, crossed the Isère by the bridge at the lower end of the plain, and entered the inn at 6.20 P.M., having descended the 7000 feet in two hours and five minutes, exclusive of the halt for dinner.

The inquiries made of Reval relative to the erection of the signal on the Sassièrè elicited no satisfactory reply; all that he could tell me was that it was "*des siècles*" ago.

I was more successful the next morning, in questioning a herdsman who occupied a chalet on the side of the Lac de Tignes. I learnt from him that the first ascent was made and the signal erected by Bertrand Chaudant, an inhabitant of Tignes, who is now dead, but has two sons living. How long ago he could not tell; it was certainly more than fifty years.

Intending to make a push for Pralognan on the morrow by the Cols of La Leisse and Vanoise, and anticipating a long day's walk, I retired early to rest, and had not been in bed half an hour before the eating-room below, which was only separated from our chamber by a thin flooring, of course unceiled, began to fill with guests. A number of the natives of Tignes had come to conclude their sabbath observances with a carouse, and for three-fourths of the night they turned the house into a pandemonium. They drank, they clinked their glasses, they sang songs, they shouted, they stamped the floor, they struck the tables with their fists, they swore, they quarrelled, and they howled, and each man as he left the inn stood for some minutes before the door and yelled and shrieked like a maniac. As if this were not enough, the douaniers were continually passing backwards and forwards through my bed-room, and when the natives retired at about 2 A.M., they continued the performance for a couple of hours more, and then it was time for us to get up. Not willingly would I endure such another night; to be thoroughly tired and drowsy, and to be kept awake from moment to moment while on the point of sleeping, is a most painful sensation.

"*Ah, Monsieur,*" exclaimed the porter as we turned out of bed at day-break, "*je ne puis plus marcher.*" In our rapid descent of the Sassièrè he had contrived to twist his knee; it was now badly swollen, and he limped fearfully. I told him to take a mule to Bourg and get surgical treat-

ment, and then return at once to Chamounix. This was an unfortunate occurrence, and one which seriously inconvenienced me in subsequent excursions, as it was as much as Michel could do to carry the baggage and instruments, without counting provisions. I regret to say that the lameness of the porter (who, by the way, had been in the Sardinian army and made the campaign in the Crimea, of which he was never weary of talking) was more feigned than real. When Michel and I met again in 1861, I inquired if he had quite recovered from his accident. "*Il se guérit bientôt*," was the reply, "*il n'aimait pas marcher si fort, vous concevez.*" We managed to get away at 5.30, and Croz having shouldered all the packages, he and I were once more on the road to the Lac de Tignes, each of us with a large piece of bread and cheese, our only provisions for the day, in his pockets. I was not sorry to turn my back upon the Auberge de St. Roch, where I had found the host and his family lethargic and unobliging, the food detestable, the charges disgracefully extortionate, and the entire absence of privacy excessively annoying.

The morning was cloudless, and from the shores of the lake we had beautiful views of the Grande Motte and the Sassiére. From the châlets at its head, the direct path leads to the Col du Palet, that to the Col de La Leisse turning sharply to the left and entering a gorge on the S., where it is joined higher up by another track from Laval. It was not long before the weather changed, and we walked through rain up to the col, which we reached at 9.30, and which was then covered with snow, extending some distance down on either side. There is a boss of rock on the summit fifteen or twenty feet high, surmounted by an iron cross. The Grande Motte rises in graceful sweeps of snow, unbroken by a particle of rock, immediately on the W. of the col, above which it did not appear to be elevated

more than 2,000 feet. We could easily have climbed it, and should certainly have done so had the weather been at all encouraging. I now looked out for the Aiguille de la Vanoise, which is placed by all the English maps S. of the col of the same name in the range westward of Entre deux Eaux. In this, the six-sheet Sardinian Survey, where the range just mentioned is called Ghiacciaja della Vanoise, is probably followed. I scrutinised attentively the district in question through a break in the clouds, but could detect no peak which at all realised my expectations, and I began to suspect that the Iseran farce was about to be repeated.

A barometer observation, compared with Turin, gives an altitude of 9068 feet for the Col de La Leisse, the Etat Major Piémontais ("Le Alpi," &c.) making it 9186.

After a halt of half an hour, I began to descend the extensive snow-slopes which occupy the upper portion of the Vallon de La Leisse, and while walking behind Croz, my attention was attracted to the colour of his footsteps. Upon the untrodden surface there was nothing at first distinguishable, but the snow when compressed by the foot was of a dull brick-red colour. I had often heard of red snow, but never noticed it, and had taken up the notion that it was brilliant carmine. On looking carefully at the untrodden snow, I could detect in it a number of red particles sparingly scattered through the mass, as if brick-dust had been mingled with the snow when falling; and I could then perceive that a large extent of it was faintly tinged with red. I filled two test-tubes with the snow, which on melting gave a copious red precipitate; this I filtered upon a piece of blotting paper, and stowed away in a pocket-book. On my return home I placed a small portion of the powder under the microscope, and immediately recognised the indisputable spherules of *Protococcus nivalis*. Having once familiarised myself with the look of red snow, there was no

chance of mistaking it for the future, and I found immense tracts of it almost daily during the remaining period I spent among the mountains.

For dreariness and desolation the Vallon de La Leisse has no rival in the Graians. It is walled in by steep slopes of crumbling black shale, without a house, without a tree, almost without a blade of grass, to relieve its dismal monotony, while below, hidden at intervals by shapeless lumps of dirt-stained snow, rolls the river, foul with mud from the disintegrated mountains. We walked down the valley until we came in sight of the river Vanoise, which, rising near the col of the same name, flows in a south-easterly direction along an elevated valley, and plunges over a cliff to join La Leisse about a mile above Entre deux Eaux.

The valley of the Vanoise has very little fall, and the river expands at intervals into a series of lakes, or rather irregular ponds of shallow water. Its sides are composed of the same black shale, and it has as dreary an aspect as the neighbouring Vallon de La Leisse. The poles were a great assistance, as we could just see from one to another through the thick mist, which prevented any inspection of the adjoining mountains. In a moment the rain ceased, a gust of wind rolled away the vapour, and I found myself at the base of a noble snow-peak, evidently the one we had seen the dark side of from the top of the Sassi re. On the left was a range of snow-topped cliffs of much less elevation, and between the two a beautiful pyramid of rock, something like the Riffelhorn, but sharper and more picturesque. It was now 1.50 P.M., and we were standing upon the Col de la Vanoise. It is possible to get down to Pralognan on the southern side of the rocky pyramid, but the poles wound round it on the N. We followed the way thus indicated, descended a rough path down the side of an old moraine, crossed the sandy bed of an empty lake,

and emerged into a sunny and verdant valley, brighter by contrast with the scenes of desolation we had left behind. In the centre of the pastures was a cluster of châteaux, called La Glière de Pralognan, to distinguish them from another La Glière in the adjoining valley of Champagny. They were tenanted by a pleasant-looking woman and a group of dogs and children, and Croz and I were soon reclining on the roof of one of the buildings, drinking cream out of large wooden bowls, and discussing and admiring the landscape. Seldom has a fairer scene gladdened the heart of a traveller. At our feet lies the Vallon de la Glière; at first stretching out in pleasant sweeps of pasture dotted over with cattle, whose bells make sweet music as they wander to and fro; then, narrowing into a steep and pine-clad gorge, rugged with huge fragments of lichen-stained rock, and opening out below into the wider vale of Pralognan. The valley is walled in on the left by nearly vertical precipices rising high above the pines, broken here and there into clefts filled with steep glaciers, above which the eye seeks in vain the long-expected Aiguille de la Vanoise. We turn round and look along the path by which we have just descended; the mountain we passed as we crossed the col forms a fitting termination to the valley. It is crowned by two white peaks, connected by a graceful curve of snow, and glistens in the sunshine with a splendour almost dazzling. "*Comment appelle-t-on cette grande montagne là-haut?*" I inquired of the bergère. With her, of course, a *montagne* was a pasture, and she replied—" *On l'appelle la Sablière, Monsieur; c'est la plus haute montagne de la vallée.*" "*Je ne parle pas du pâturage mais du grand pic de neige.*" "*Ah, Monsieur! c'est autre chose! je ne saurais vous dire cela!*"

Unable to get any geographical information, I ques-

tioned her upon the hotel accommodation at Pralognan. She told us there were two auberges, one near the church and another in a separate cluster of houses above it, which was kept by her father. The latter, she said, had an advantage over the other in the possession of two mattresses, upon which travellers might be bedded. An hour's walk from La Glière brought us to the village, and at 4.30 p.m. we stepped into the auberge of Marie Joseph Favre, ordered dinner, and inspected the sleeping apartment. This was a good-sized room, approached by an outside staircase, with a dirty floor and two large four-posters, smelling, like many bed-rooms in the Alps, as if it had been built in the time of Adam and been kept shut up ever since. I immediately put both door and windows wide open, Madame Favre in the meantime looking on with consternation. The people of the inn were extremely civil and obliging; and although I had to share my bedroom with Croz, I had an eating-room to myself, and was thankful for the privacy. The *cuisine*, too, was a trifle superior to that at Tignes; the bill of fare included salad, and a dish which looked like pigs' puddings. The latter were not attractive; but as I failed to pierce the cuticle with the cutlery at my disposal, I am unable further to report upon them.

I did not awake until after 11 A.M. on Tuesday, the 2nd of August, and happily lost no time by this, as it was a dull and rainy day. After breakfast, the first step was to summon Etienne Favre, the best chasseur of Pralognan — a man somewhat *passé*, but well acquainted with the neighbourhood. According to him, the great snow-mountain between the Col de la Vanoise and the valley of Champagny was La Grande Casse, and the range on the opposite side La Rechasse. He knew of no peak called l'Aiguille de la Vanoise, unless it were the pyramid of

rock, which he declared was at Pralognan called "l'Aiguille" simply. I next questioned him about the passes into the Maurienne. Besides the mule-track of the Col de la Vanoise to Thermignon, there were, he said, two routes diverging from La Motte, the highest châteaux in the valley of the Doron; one by the Col de Rosoire, descending upon the forts of Aussois, the other by the Col de Chavière, leading directly to Modane. Both these cols, he added, were much higher than the Vanoise, but the Rosoire was the easier of the two, and had less snow on it than the other.

Having engaged Favre's services at the moderate sum of five francs to assist in an attack upon the Grande Casse on the morrow, I strolled out to examine Pralognan, one of the most picturesque spots in the Graians. It stands just at the point where the valley of La Glière opens at right angles into that of the Doron, and where the river making a sharp elbow incloses a small plain of beautiful meadows and carefully-tended plots of cultivation, embosomed in far-stretching forests of pine, over which rise the noble precipices of the Rechasse. Below the church, two remarkable domes of rock, furrowed, scratched, and polished from base to summit, bear witness to the ancient extension of ice in this region of the Alps. The height of the village by a barometer observation at 6 P.M. on the 6th, compared with Turin, is 4700 English feet.

On Wednesday the 8th, I left the inn at 3.55, accompanied by Croz and Favre, and retraced my steps up the valley of La Glière towards the Col de la Vanoise. The sky, which was clear at starting, quickly became clouded, but in an hour's time the mists all rolled away, and the morning brightened gradually into a brilliant day. We gained the col at 6.35, having walked very slowly; for I had bruised the Achilles tendon of my right foot in my last day's walk, and it was

extremely painful. Favre's heart now began to fail him as we gazed upwards at the glittering peaks of the Grande Casse, and he suggested that it would be a safer game to aim at the Rechasse. His advice is scornfully rejected, and the great mountain for the first time in its existence feels the pressure of a human foot. A short climb up the rocks brings us on to some easy snow-slopes by the side of a glacier descending on our right; we soon reach the higher snows beyond, and zigzag steadily up them until we arrive, without difficulty, at the foot of a very steep and lofty slope of snow, terminated upwards by a hollow between the two culminating peaks which stand right and left before us. Thinking it wiser to be unattached, we leave the rope and all the heavy baggage, except the barometer, behind us, and for the first time in the day Croz brings his axe into play. To climb to the top of the slope, which was ascertained by the clinometer to have an inclination of 45° in its steepest part, costs us 1,100 steps, 800 of which are axe-cut, the remainder punched in with the toes. This obstacle surmounted, what appeared a hollow from below turns into a level corridor crossing the main range of the mountain; on our right is an easy dome of snow; on our left the wall of the corridor, rising into a snow arête, with a very sharp peak at its extremity. We are soon on the top of the dome, looking down upon the Grande Motte; but the other, or western peak, being evidently the higher, we run back into the corridor, and climb to the crest of the arête. This is disagreeably sharp, and rises precipitously on its further side from a valley, along which there is probably a glacier pass from the Col de la Vanoise to La Glière de Champagny. Keeping well on the eastern face of the arête, we advance cautiously towards the peak until we are clear of the corridor, and have now nothing on our right but the valley of

Champagny, 6,000 feet below. A few paces more and the highest point of all is about five feet above Croz's head; but now a single step forward cannot be taken without grave imprudence, and the piece still unclimbed is rather too big to knock off. It is not easy to observe when all the faculties of the mind have to be concentrated upon preserving one's balance, so, retreating a short distance, I flatten a halting-place about thirty feet below the summit, and set up the barometer.

Time, 11.45 A.M., barometer reduced . . .	477.89 mill.
Air temperature	2.0 Cent.
Altitude from comparison with Turin . . .	12,813 English feet.

The height given by Corabœuf for the Aiguille de la Vanoise is 12,674 English feet. It is quite certain, as I shall show in the sequel, that this measurement applies to the Grande Casse, and as it is considerably below that obtained by a comparison of my barometer observation with Turin, it is desirable that this should also be compared with Geneva and St. Bernard. Assuming that the index error of my barometer was the same as when I compared it at Geneva in 1861 (a somewhat hazardous hypothesis, as the instrument had a new tube in the interval),—we obtain

Geneva	12,824 English feet.
St. Bernard	12,615
Mean of Geneva, St. Bernard, and Turin . . .	12,751

Adding 29 feet to the latter for the height of the summit above the spot where the reading was taken, we get 12,780 feet for the altitude of the mountain, which may be provisionally adopted until it is corrected by future observations.

The view from our standing-place, excepting where it was provokingly intercepted by the final peak, was similar in its general features to that from the Sassièrè, but was

more extensive towards the S. and W. Immediately below us, and much less elevated, lay the Rechasse, a nearly level plateau of snow and ice of immense extent, with a rocky peak at its farther extremity, overhanging the Maurienne. This was the Dent Parassée, the third highest mountain in the western Graians, with the Viso and the Alps of Dauphiné on either side of it in the far horizon. On mounting the level, it swept over every peak of the central and western Graians, except the Mont Pourri, the top of which was exactly intersected by the optic axis. The two mountains being eight and a half miles distant, it would follow that the Pourri is slightly the higher; but an observation with a theodolite made in 1861 from a point near the summit of the Grivola, leads me to an opposite conclusion. The difference is certainly very small, and it yet remains to be proved which of these two peaks is entitled to the supremacy of the Tarentaise.

We commenced the descent at 12.30, and soon arrived at the steep snow-slope below the corridor, which required extreme caution, and I found it essential to throw aside my veil. This was annoying, as the mid-day sun shone directly upon the slope, and was reflected into my eyes by the myriad facets of the snow crystals, dark spectacles notwithstanding. I knew well enough what would come of this, but, snow-blindness being preferable to a broken neck, it had to be endured. I was at any rate better off than Favre, for mountaineering being a novelty in these parts, he had no spectacles, and indeed walked with an unspiked pole. At length we trusted to a glissade, dashed swiftly down the slopes, and at 2 were on the rocks again. Here we rested half an hour in full view of the beautiful "Aiguille," speculating whether it could be climbed or not, and at 3.30 regained the col, where I set up the barometer.

The resulting altitude, from a comparison with Turin, is 8190 feet, that determined by the "Etat Major Piémontais" ("Le Alpi," &c.) being 8271. At 5 o'clock we reached Pralognan; giving Favre instructions to be ready on the morrow for the passage to Modane, I wandered among the meadows in search of a bath, returned to the inn to supper, and then turned into bed.

"Snow-blindness," which, by the way, is not blindness at all, but merely a painful affection of the eyes, comes on with curious suddenness. I had hitherto felt no uneasiness; but on putting up the barometer in the bed-room to get a second determination of the height of Pralognan, I was surprised to find I could not read the vernier, and in a few minutes the malady attacked me with all its fierceness. It generally commences just as it becomes dusk, and sometimes lasts for several days. The eyelids are burning hot, and open and shut convulsively with showers of scalding tears, the eyeballs smart, and light is unendurable. It is one of the few unpleasant effects of mountain travel, and every precaution should be taken against it.

As may easily be imagined, I slept very little on the night of the 8th, and on rising in the morning I found at the inn, not the chasseur, but his wife, who had come to tell me that her husband had a "*mal aux yeux affreux*," and could not leave the house. I would gladly have stayed indoors myself, but I knew I should be very hard pushed to keep my appointment at La Bérarde. I gave the chasseur's wife ten francs, as her husband's pay for the previous day's expedition, which elicited the most profuse expressions of gratitude, and, engaging a son of the landlord as porter, I put on spectacles and veil, and started at 6.45 for Modane.

Crossing the Doron to the opposite bank, we walked up

the plain of Pralognan until the path reached the rocky slopes on the western side of the valley, from which we had a noble view of the Grande Casse and the head of the Val de la Glière,—a scene I would have sketched, had I been able to look at the mountain for more than a few seconds. The path then keeps along the river-side until the last châlets are reached, about a mile above La Motte. Here we had before us some fine sweeps of snow, ending upwards in the Col de Chavière, which was guarded by a striking peak on the right. We ought to have crossed by this col and climbed the peak *en route*, but I dreaded walking on the snow; and being assured by young Favre that there was less upon the other col, and that it was quite as short a way to Modane, both of which statements were untrue, we struck into a track on the left, which wound up some grassy slopes on the eastern side of the valley. From time to time we turned to look back along the vale of Pralognan; its bounding ranges inclosed, as in a frame, the jagged aiguilles and shining snows of Mont Blanc, which looked far more beautiful than when seen in a panorama—the highest among a thousand other peaks. Had we been crossing the Chavière we might have had a still finer view from the col itself; but we soon lost sight of the picture, and were scrambling over ridges of rock and slopes of débris, varied by wide patches of snow. While climbing up the rocks, I came upon some fine specimens of *Primula viscosa*, and transferred several of them to a folio. Favre looked on in amazement. Were they good for tisane? he asked. Not that I know of, was the reply; he did not believe me, however, and stuffed his pockets full of them. After making several mistakes in the way, of which he appeared to have no very accurate knowledge, we at last reached the summit level exactly at noon. We were standing near the southern extremity

of the great snow-field we had looked down upon from the Grande Casse; on the one side the rocky peak called the Pointe de Massa divided us from the Col de Chavière, and on the other the Dent Parassée and the Roche Chévière were probably visible; but I was too blind to make an accurate survey.* With considerable difficulty I succeeded in reading the barometer vernier, and by a comparison with Turin the height comes out 9,628 feet (Time, 12.20 P.M.) Even at this elevation phænogamous vegetation was not wanting; all the crannies of the rocks were filled with the green cushions of the pretty *Androsace glacialis*, studded with white star-like flowers. The descent on the side of the Maurienne was down a most picturesque valley, consisting of a succession of plains, looking like the sites of ancient lakes, now pasture-covered and browsed by cattle, and separated from one another by steep slopes of pine-clad rocks. We soon gained the summit of the last slope, and looked down upon the forts of Aussois and the great road of the Cenis; here I believe we might have made a far more direct cut to Modane by keeping well to the right, but I did not like to risk it, as I was fearful of not being able to get across the Arc. We therefore bore down upon Aussois, and after threading the almost interminable zigzags of the forts arrived in the Cenis road. A quiet walk brought us to Modane; exactly at 5 I entered the comfortable Lion d'Or, and got the first real dinner I had eaten for a week.

Modane is now well known from its contiguity to the Savoy end of the tunnel by which the Victor Emmanuel

* The Roche Chévière was one of the trigonometrical stations in the survey of the Arc of the Mean Parallel, and the mountains in the vicinity, including the Cols of Rosoire and Chavière, are admirably delineated in one of the small maps. One of the panoramic views was also taken from this station. The Col de Rosoire is called also Col de Rosué, de Rosou, and d'Aussois.

railway is being carried through the Alps, and which is usually called the Cenis tunnel, in consequence, I suppose, of its great distance from that pass. I spent the morning of the 10th in examining the works, which are but a few minutes' walk from the inn, and in the afternoon took a carriage to St. Jean de Maurienne. The following day I went to Frenet on the road from Bourg d'Oysans to Briançon by way of St. Jean d'Arves and the Col du Pré Nouveau, and two days subsequently I joined my friends at La Bérarde.

My short ramble among the Savoy Graians, though on the whole a pleasurable and interesting one, had been sadly marred by the fearful accommodation that the traveller has to put up with in these parts. The want of wholesome food, and especially of good meat, had produced a state of digestive disorganisation, which I did not get over for weeks, and which was of course accompanied by a corresponding diminution of muscular force. Let me, however, not be unjust to the valleys of the Tarentaise. They contrast most favourably with the unfrequented parts of Dauphiné, where there are some of the foulest dens in the whole range of Alps.

Before passing on to the excursions of 1861, I may mention here that Mr. J. J. Cowell travelled in the Graians in September 1860, and that in crossing the Col d'Iseran he was just as unable as I was to discern the faintest traces of the mountain of the same name. To him belongs the honour of having, in a paper contributed to Mr. Galton's "Vacation Tourists," first directed public attention to this extraordinary fiction.

NARRATIVE OF EXPLORATIONS IN 1861.

In the year 1861, when the Alpine season was approaching, an irresistible impulse urged me to the Graians. I felt the strongest desire to visit the Grivola and other peaks of the eastern section, and also to endeavour to clear up some of the points which were unsolved by my previous year's journey. Among these the most important was the relative altitude of the Grande Casse and the Mont Pourri; in a case of such nicety I felt convinced a pocket-level would be useless, and I therefore carried with me a theodolite by Messrs Troughton and Simms, especially adapted for work upon the mountains, with the intention of commencing the campaign by climbing the Pourri, and levelling accurately from it to the summit of its rival.

After former experiences, it may readily be imagined that I was anxious to spend as few nights as possible in the valleys of the Tarentaise, and I thought I could not possibly do better than select as head-quarters the Hotel du Mont Blanc at Aosta, kept by Jean Tairraz, the most genial and obliging of landlords, where the lodging and *cuisine* are alike irreproachable. The natural course would have been to leave the railway at Chamousset, as in the previous year, drive to Bourg St. Maurice, attempt the Pourri from the Val Peisey, and then cross the Little St. Bernard to Aosta. But I was under the necessity of going, in the first instance, to Geneva in order to compare my barometer; and as I was rather over-burdened with instruments, I determined upon crossing the Great instead of the Little St. Bernard,

and leaving the baggage at Aosta before entering the Graians. I was the less disinclined to take this route as it would enable me to go into the Tarentaise over the top of the Ruitor, a mountain I had long wished to examine, and I fancied that the Pourri expedition would not be prejudiced by shifting the point of attack from Peisey to St. Foi.

I accordingly instructed my old guides, Jean Baptiste and Michel Croz, to be in attendance at Martigny on the 4th of August. My friend Mr. F. W. Jacomb being also desirous of exploring the Graians, we agreed to attack them in concert, and leaving London by the tidal train on August the 1st we reached Geneva on the 3rd. On the evening of the 4th we arrived at Martigny, and found our guides awaiting us, and on the following day we took a carriage up the Val d'Entremont as far as St. Pierre. A ramble to the S. of the Combin by the Combe de Valsorey was the means of rectifying a geographical misconception I had fallen into in my previous journeys in this district, but it brought with it at the same time the disagreeable consciousness that I was far from well, and should be unfit for mountaineering for several days to come. On the morrow, therefore, I simply walked over the St. Bernard, while Jacomb, taking the guides, went by way of the Col de Sonadon and Ollomont to Aosta,—a very interesting expedition, which forms the subject of a previous paper in this work.

We entered the Hotel du Mont Blanc nearly together on the evening of the 7th, I, destined to spend three or four days of enforced idleness, but deeply thankful that I had alighted upon so agreeable a resting-place. Jacomb in the meantime, with great good nature, abstained from advancing into the Tarentaise, and occupied himself and the guides in raids upon the Becca di Nona and the Mont

Gelé. The weather was absolute perfection, and the snowy peaks of the Ruitor, by far the most beautiful feature in the mountain views from Aosta, glistened from morn to sunset with the most dazzling brightness. On the second day after our arrival my friend, Mr. George Barnard, so well known as an artist by his beautiful representations of Alpine scenery, drove up to the hotel. I at once asked him to make me a drawing of the Ruitor; he obligingly



THE RUITOR, FROM AOSTA.

consented, and stayed at Aosta two days for the purpose. In his agreeable society I felt less acutely the pangs of inaction, and we strolled together about the outskirts of the city searching for the best point of view. After several unsuccessful trials, a thoroughly satisfactory

position was at length discovered, and the sketch was made from the summit of a vine-covered eminence on the N. side of the Chatillon road, a few minutes' walk beyond the Roman bridge. A woodcut from a portion of Mr. Barnard's drawing is on the preceding page.

The Ruitor is a portion of the range of the central Graians included between the little St. Bernard and the lower part of the Val Grisanche, the snowy face of the mountain as seen in the woodcut belonging to the western flank of that valley. Of the peaks in view, the one on the extreme right, after a lengthened examination, was pronounced to be the highest, and selected as the point towards which our steps should first be directed. It was not until Monday, the 12th, that I felt sufficiently recovered to commence climbing, and at 9.15 on the morning of that day, accompanied by our two guides, we left the Hôtel du Mont Blanc in a carriage and pair, and drove to Ivrogne, a village beautifully situated at the junction of the Val Grisanche with the Val d'Aosta. On our way to this place we passed in succession on our left hand the entrances of the valleys of Cogne, Savaranche, and Rhêmes, and had a charming glimpse of the snow arête of the Grivola from the town of St. Pierre. We reached Ivrogne at 10.45 and went to a tolerable inn, where we made a very substantial lunch, and where I engaged the services of Charles Alexis Luboz at five francs a day, for the express purpose of carrying the theodolite. Although this man was ignorant of the district we were about to visit, and unused to mountain work, I am happy to be able to speak of him in terms of unmixed commendation; and I have no doubt he is now perfectly competent to act as guide to any of the peaks or passes of the central Graians.

Having laid in provisions for two days, we left Ivrogne at 12.45, and entered the Val Grisanche. The lower part

of the valley is thickly wooded—the dark green foliage of the chestnut and walnut contrasting with the greyer tints of the poplar and willow. On quitting the forest, we traversed a defile, with a glacier stream below us on the left; on the opposite side of it rose a lofty and precipitous rock, crowned by an ancient castle, which appeared to occupy the centre of the valley, and to have a river on both sides of it. We had now reached a part of the valley where there was not an atom of shade, and the heat was almost insupportable. Thousands of lizards, racing along the burning soil close to us, seemed thoroughly to enjoy it; what would have become of us I know not, had we not discerned in the distance an overhanging rock with a splashing stream beside it. We struggled up to it, threw ourselves down under the refreshing shade, and thrust our hands and heads into the delicious water. Beyond here the heat was less oppressive, as the path ran alongside the river, which imparted a grateful coolness to the air as it cascaded by moss-covered boulders, with a thick intergrowth of bilberries laden with luscious fruit. Farther on appeared another crag, with a square tower on its summit; we wound round its base, steadily mounting, and on reaching the top of the ascent the character of the valley changed in an instant. We crossed the river, which we now discovered was not the main stream of the valley, but a tributary from the Ruitor, and at once stepped on to a long, narrow, and monotonous plain, which extended to a great distance before us, while Planaval, the first village of the Val Grisanche, lay in an opening on the right. The route usually followed to St. Foi ascends the valley to Fornel, a village much farther up, and then turns the main chain immediately to the S. of the Ruitor by the Col du Mont, descending directly upon St. Foi. We, however, being anxious to pass straight over the top of the mountain,

sent our guides to ascertain the position of the highest sleeping-place, and they were directed to some *châlets* high up behind the village, about two hours distant. A climb along a very zigzag path brought us on to a steep tract of open pastures; we mounted up them to a summit ridge, and, descending a short distance on the farther side, entered a sequestered valley, with a group of *châlets* in the centre, which we reached at 6.30.

The ridge which we had crossed may be seen in the woodcut, where it appears in front of the mountain on the right hand side. The head of the valley behind it is occupied by a large glacier, the main outlet for the snow-slopes seen so conspicuously from Aosta, which give rise to the river, along which we had mounted the Val Grisanche below Planaval. Our arrival gave no little surprise to the *berger* in charge of the "Alp," as it was the first time he had ever entertained travellers: so far removed indeed is this settlement from the ordinary haunts of men, that it is called simply "*les châlets du Glacier*," the glacier itself being nameless.

After a tolerable night in a hay-loft, we sallied forth at 5 on the morning of the 13th, and a walk of three quarters of an hour brought us to the glacier, a very fine, regularly developed one, deeply crevassed in parts. Mounting up, we made our first halt where the curving ridge above mentioned strikes out of the mass of the Ruitor, a point which commands the valley of Aosta, nearly as far down as Chatillon. The sun shone beneath a sable cloud, and the wide waters of the Doire flashed with golden light as they rolled along the far-stretching valley. We now turned our faces towards what we supposed to be the terminal peaks of the mountain, and after several *détours* to avoid crevasses, we arrived at the foot of the right hand, or northern one, at 8.15. Finding some convenient rocks

and a stream of running water, we rested an hour for breakfast; at 9.15 we were off again, and climbing partly up precipitous rocks and partly up steep snow-slopes, gained the summit without difficulty at 9.40.

The architecture of the Ruitor proved very different from what we had expected. We were standing upon the most northerly tooth of a long serrated ridge, separated from a second similar and parallel ridge in front of us by an immense field of snow, the upper part of the great glacier of the Ruitor, which flowed down on our right towards La Thuile on the Little St. Bernard. The peak we had climbed was, as we had supposed, higher than the next one on the S., but on levelling along the ridge we found that another peak still more to the S., and quite invisible from Aosta, overtopped us. We were, however, higher than any of the serratures of the opposite ridge, one of which presented an evidence of a previous visit, in a stone man on its summit.

Just as the Cramont on the southern side of Mont Blanc corresponds as a point of view to the Brevent on the northern, so may the Ruitor be said to answer to the Buet. From our standing-point we looked straight over the Cramont to the Italian face of Mont Blanc, the whole range of which was extended before us from the Col de la Seigne to the Col Ferret. For the only time throughout our journey of 1861 the weather was not perfect, and the chain was provokingly obscured by clouds; but we saw, nevertheless quite enough to convince us that the Ruitor is one of the finest points of view for the southern side of the mountain.

At 10 A.M. the instruments were observed, and the readings were as follow:—

Barometer reduced	. 510.80 mill.	. 20.113 inches.
Air temperature	. 10.6 Cent.	. Moist bulb, 6.0 Cent

From which we have —

Turin	11,359 English feet.
Geneva	11,348
St. Bernard	11,309
Mean	11,339

Taking into account the difference of level between the point where this observation was made and the highest peak, we may, I think, put the height of the latter at 11,400 feet. Ziegler in his "*Hypsométrie*" gives 10,945 English feet for the Ruitor, on the authority of Bartolomeis, method not stated. This is certainly erroneous.

We left the summit at 10.20, and descending on to the Ruitor glacier, we crossed once more on to the eastern face of the mountain overlooking Aosta, by a narrow opening between the two peaks, and rested a quarter of an hour by the side of a charming glacier lake, with a number of miniature icebergs floating on its surface. Passing again on to the western side, we advanced up the Ruitor glacier until we arrived at the summit level, beyond which it descends to the S., and has evidently a second outlet in the branch of the Val Grisanche, which leads from Fornel to the Col du Mont. The highest peak flanks the summit plateau upon the east: we intended at first to climb it, but reluctantly abandoned it for want of time. Our next efforts were directed to effecting a descent upon the Col du Mont; but all our attempts being suddenly checked by formidable cliffs of snow, we retraced our steps to the plateau and descended the glacier in the opposite direction, scanning every opening to the westward. On reaching the foot of the cairn-crowned rock immediately opposite the peak we had climbed in the morning, a deep valley opened out to the left. Snow-slopes of fearful steepness circled round its head, and a yawning bergschrund separated them from the more level glacier, beyond which there was a

glimpse of distant pastures. A great deal of step-cutting brought us by a long *détour* to a place where the crevasse was passable; once across it we trusted to a glissade, and quickly landed on the more gently-sloping ice. At 3 P.M. we reached an old moraine near the extremity of the glacier on its left bank, rested an hour for dinner, and then descended on to a beautiful Alp called La Sassièrre de St. Foi.

There is a little village of *châlets* on this Alp, and our arrival appeared to cause as much surprise as had been displayed at the *Châlets du Glacier* on the preceding evening. We were asked if we had come from the Val Grisanche, and on our answering in the affirmative, were told that we had altogether missed the way, and had made a great *détour*. On inquiring the nearest road to St. Foi, we were directed into a path which joins one from La Thuile a little below the village, and we descended one of the loveliest valleys in the Tarentaise, where pasture, rock, and pine-forest are grouped together in exhaustless variety, and where the magnificent peak of the Mont Pourri, rising beyond the Val de Tignes, forms a noble background to each successive picture.

We were walking swiftly along the footpath, and had arrived at a group of houses in the outskirts of St. Foi, when the fact of Savoy being in France was forced upon us with disagreeable prominence, by a *douanier* placing himself before us and summoning us into an adjoining building. Here we were accosted by a superior officer, who "visited" our baggage with excessive strictness, carefully inspecting the barometer and theodolite, which seemed to puzzle him not a little, and examining every single article in every knapsack. He apologised for the trouble he was giving us, saying that he had received especial orders from Paris to make a diligent search for

pamphlets, a number of which, "calculated to excite hatred against the government," had been passed across the frontier. He told us that his station was "*bien triste*," and that we were the first travellers he had captured that year. After a disagreeable detention of nearly half an hour we were allowed to proceed on our journey, and we entered St. Foi at 6.30 p.m., when we went to the Hotel du Mont Blanc.

This auberge smacks strongly of the Tarentaise, but is many degrees superior to the inns of Tignes, and we got a tolerable supper. Jacomb and I slept in a large double-bedded room, and in the middle of the night I awoke out of a sound sleep, and saw my companion, with a lighted candle at his side, sitting bolt upright, and tearing wildly at the bed-clothes. Happily I was either less susceptible or less tormented, and I soon dropt asleep again. On the morning of the 14th we made some inquiries about the Pourri, which of course elicited the universal answer, that it was utterly inaccessible both on the St. Foi side and on that of Peisey. Wishing to get some more trustworthy information, I sent Jean and Michel up to La Thuile*, the next village in the valley, to try to engage Ruet (a chasseur spoken of in Murray as well acquainted with the mountains), or some other guide. While they were away, Jacomb and I strolled out to the meadows and lay upon the grass under the shade of the walnuts, eagerly examining the peak. For once I was disposed to agree with the natives, as I really could not detect any practicable route to the summit. It was not long before our two guides returned with the intelligence that all the chasseurs in La Thuile were "*à la chasse*," but they were informed that the

* This La Thuile must not be confounded with a previously mentioned village of the same name on the road of the Little St. Bernard, above Pré St. Didier.

only probable way of climbing the mountain was to attack it from the Lac de Tignes. This statement I knew must involve some great misconception, as between the Pourri and the Lac de Tignes the chain is divided by the deep ravine, along which lies the route of the Col de la Sache from the Val Peisey to Brévières. We therefore decided upon ascending the Val de Tignes to the last-named village, and there seeking further information.

Having supplied ourselves with provisions for two days we packed them on the back of a mule, along with all our other baggage, and leaving St. Foi at 2.25 commenced the ascent of the Val de Tignes. The weather was much finer than when I had last passed along the same track in 1859, and I thought I had rarely rambled among more beautiful scenery. We passed through La Thuile at 3, where there is an inn of promising exterior, called the Hotel des Voyageurs. At 4.45 we passed on the left a thundering cascade, which issues from one of the principal glaciers of the Sassièrè, at present quite unexplored, and at 5.10 we entered Brévières. Here we found the curé and several villagers playing at bowls; we engaged in conversation with them on the subject of the Pourri, when one of the natives, a man of loud voice and unpleasant volubility, said he had been within a few steps of the summit, and volunteered to conduct us. With considerable difficulty we struck a bargain with him, and after resting at Brévières till 6.20, we placed ourselves under his direction, crossed the Isère, and at once began to mount through a pine forest towards the châlets of Marai, where he said it would be necessary to pass the night. When we arrived at the open pastures, the Pourri came into view on our right, and we thought we could see to the summit. We now called upon our new guide to point out the spot he had reached, upon which he indicated a part of the mountain

about four hours below the top, and beyond which the route was apparently impracticable. We at once pronounced him a humbug, and as his garrulousness had become perfectly insufferable, we gave him a small gratuity and sent him about his business, to his great disgust. A few minutes brought us to the châteaux, which we reached at 7.30, just as it was getting dusk.

The Alp of Marai is situated on a mountain-spur which intervenes between the Lac de Tignes and the valley of La Sache, and is one of the most delightful spots in the vicinity of Tignes. From an elevated grassy knoll in front of the châteaux, we looked down the Isère towards St. Foi, beyond which the chain of Mont Blanc, from the Col du Bonhomme to the Aiguille du Géant, was inclosed as in a picture by the bounding ranges of the valley. It formed a scene of exquisite beauty with its cold snows and jagged aiguilles projected against the evening sky; but soon after sunset, when illuminated by the moon nearly at the full, it seemed more like a vision of the realms of Faëry than a stern reality of the Alps. Removed as these châteaux are from the ordinary tracks of tourists, they are not entirely unknown to English travellers, having been visited by Mr. and Mrs. King on the way from St. Foi to the Lac de Tignes.

We found them excellent mountain quarters, and we hastened to gratify our appetites with the many luxuries which unlimited milk places within the reach of the mountaineer. Foremost among these is the seductive product named *fleurette*, *brousse*, or *niedl*, so well known to Alpine travellers, and the praises of which have been sung by Mr. Tuckett in his paper on the Valpelline. After an excellent supper, which included several bowls-full of this delicious article of diet, we retired to rest on a great heap of hay in a corner of the châtlet.

On the morning of the 15th we started at 4, and commenced our expedition by the distasteful but necessary process of descending into the ravine which separated us from the Pourri, and which is connected with the Col de la Sache. The mountain rises immediately from the base of the ravine, and presents on this side a very steep amphitheatre of rocks, encircling a small glacier with a moraine by the side of it. At the base of the mountain, the rocks and pastures were bright with Alpine flowers; among others we found a large quantity of *Artemisia mutellina*, "*le vrai g  n  py*," a plant held in great estimation by the peasants, who extract from it a sudorific medicine. We climbed up the moraine and then took to the rocks, aiming at the point we had considered the summit when we had examined the mountain on the ascent from Br  vi  res. We found them exceedingly difficult, as they consisted entirely of shattery quartzite, breaking away at every step beneath our hands and feet. I suppose this structure has been the origin of the name Mont Pourri, which we may translate into English as Rottenberg, and which certainly is most appropriate. On gaining the point we were making for, it turned out to be no summit at all, but merely a part of one of the ridges of the mountain; but now a snow-peak appeared in view in the direction of the Val Peisey. We turned our faces towards it, and after carefully cutting our way along a succession of difficult snow ar  tes, we landed on a nearly level snow plateau, the reservoir supplying the numerous glaciers which seam the face of the Pourri on the side of Val de Tignes. Here we found to our horror that we had entirely overshoot the mark, and made what Michel Croz called "*une grande b  tise*." There was the snow-peak plain enough before us almost close at hand, and with an easy slope to its summit; but much farther off, and nearer to St. Foi,

the true terminal peak of the mountain shot out of the snow, and presented itself as an apparently inaccessible pyramid of black rock. Under these circumstances we resolved to ascend the lower peak, and at 11.10 we stood upon its summit. The ascent had thus cost us seven hours and ten minutes, of which, however, only six had been actual walking.

The point we had reached is the extreme south-western extremity of the snow-plateau of the Pourri, overhanging the head of the Val Peisey on the one side, and the ravine of La Sache on the other. It was, in fact, the lower of the two peaks I had examined the previous year from the Sassi re. We looked around upon a cloudless horizon, surmounted by a dome of the deepest blue, but the view being of the same general character as from most of the summits of the Tarentaise, it is unnecessary to describe it in detail. Mont Blanc, Monte Rosa, the Viso, and the Pelvoux stood at the four corners of the mountain panorama, and within them rose a multitudinous array of peaks, the Grande Casse, which presented to us its dark precipitous side, being the most striking. I could now make out distinctly the position of the Col d'Iseran, and I received renewed evidence, if such were wanting, that the Mont Iseran is an imposture.

Exactly at noon the following observations were taken :

Barometer reduced	. 501.27 mill.	. 19.742 inches.
Air temperature	. 8.3 Cent.	. Moist bulb, 3.5 Cent.

From which we have —

Turin	. . . . .	11,787 Eng.feet.
Geneva	. . . . .	11,755
St. Bernard	. . . . .	11,766
Mean	. . . . .	11,769

It thus appears that we were considerably lower

than the Sassièrè, and indeed, on levelling, it was clearly several hundred feet above us. After reading the barometer, I tried to ascertain the boiling-point with an instrument constructed by Mr. Casella; but although all the spirit was burnt away, the water would not boil, and the flame of the lamp was invisible. It was too late in the day to justify a closer examination of the final peak, which still elevated itself about a thousand feet above us, even had it looked more encouraging than it did; and having satisfied ourselves that the Val Peisey was the proper side from which to attack it, at 12.50 we turned to descend. We reached the highest pastures at 3.30, rested half an hour, and regained the châteaux at 4.45.

Here we debated where we should direct our steps on the morrow, and I believe a descent into the Val Peisey and a renewed attack upon the Pourri was suggested. Both Jacomb and I, however, longed to get back to our luxurious quarters, *chez* Jean Tairraz, and it did not require many minutes to decide that we should make a push for Aosta by way of the Col de Gailletta. Unhappily, this necessitated passing the night at Tignes; I had no wish to renew my acquaintance with Revial, and by the advice of a native whom we met in the châtlet, we determined to give a trial to the auberge of Constant Arnaud. Before descending to the village we made a détour to the Lac, and having indulged in the luxury of a bathe, we strolled quietly down to Tignes and entered the auberge at dusk.

Arnaud's *cuisine* was certainly a trifle better than that at the other inn, and the host did his best to make us comfortable. Of the sleeping arrangements the less said the better; Jacomb had a bed in the room we had supped in, and I passed the night in a dirty den adjoining.

Unhappily, I was afflicted by a severe attack of snow-blindness, which would have prevented sleep even had it otherwise been possible. Before retiring I had impressed upon Jacomb the importance of starting not later than 4, as we had a very long walk before us, but when I entered his room in the morning of the 16th long after that hour, I found that he, like myself, had been severely preyed upon, and had passed a sleepless night. He begged hard to be permitted to lie another hour, and ultimately it was not until 7.30 A. M. that we turned our backs on Tignes. My eyes were still extremely painful, and I was obliged to walk nearly all day in spectacles and veil.

Crossing the Isère, we climbed up by the side of the cascade, as I had done the preceding year, to the grassy valley under the Sassièrè; which we now followed on its northern side until we came to the lake, which is not clear and sparkling like the Lac de Tignes, but of a dull green colour, the glacial mud carried down by the streams that feed it being held in suspension by its waters. Beyond here our route lay up slopes of mingled rocks and pastures, when suddenly a very fine glacier appeared in view before us, with a striking snow-peak on the right, which bears on the large Government Map the extraordinary name of Le Grand Apparei, and which cannot be much less than 12,000 feet in height. We kept along the rocks on the northern side of the glacier until we were well past its most broken part, and then taking to the ice we threaded our way among a number of really difficult crevasses to an extensive snow-plateau on the summit level, which proved much more distant than we had expected. We arrived here at 1.10 P.M., having been five hours and forty minutes in ascending from Tignes, including halts of forty-five minutes; but we walked very slowly, as we both were half knocked up by want of rest the night before.

The pass, which is called the Col de Gailletta, is one of the finest in the Graians, and both in its foreground scenery and in the extent and interest of its distant views may indeed bear comparison with some of the more celebrated cols of the Pennine or Oberland Alps. The summit of the col is far in advance of the Sassiére; as we faced the Val de Rhêmes we had upon our left hand tracts of snow of immense extent, stretching towards the head of the Val Grisanche. On our right was Le Grand Apparei, and immediately in advance of it a most peculiar peak, consisting of a tower of dark rock, capped by a cone of snow. On the side of Savoy, beyond the Lac de Tignes, rose the graceful snow-peak of the Grande Motte, and the frowning precipices of the Casse; while on that of Piedmont we looked over the Val Savaranche to the magnificent masses of the Grand Paradis and the Grivola, and straight down the Val de Rhêmes to a section of the Pennine chain, of which the Grand Combin formed the central summit. By the help of Jacomb's eyes, a hypsometrical observation was secured: at 1.30 P.M. the readings were as under:—

Barometer reduced . . .	529.97 mill.	20.874 inches.
Air temperature . . .	9.7 Cent.	Moist bulb, 6.8 Cent.

Whence we have —

Turin	10,179 English feet.
Geneva	10,120
St. Bernard	10,149
Mean	10,149

We started again at 1.45 and commenced the descent into the Val de Rhêmes. The head of this valley consists of an immense amphitheatre, containing not less than four or five distinct glaciers, all most imperfectly shown on the maps. It is divided into two bays by a projecting promontory,

of which the remarkable tower-like peak above described forms the terminal point, and which is a most striking feature in all the views from the upper part of the valley. We descended close to it keeping it on the right, and after a rather difficult scramble down some rough rocks alighted at 3 P.M. upon a spacious alp, where we rested for dinner. Owing to the late hour at which we had quitted Tignes, I had all along looked upon reaching Aosta that day as something too absurd to be thought of, and had anticipated passing the night either at a chalet or at Notre Dame de Rhêmes, the highest village of importance. Now, however, Jacomb suggested that if we put on a spurt we might after all get to Aosta, and when we had finished our dinner at 3.45 we at once struck into a pace of about five miles an hour. It was rather a pity to walk so fast, as the scenery in the upper part of the valley is of striking grandeur, and is in itself well worthy of a visit; lower down, however, it is tame and monotonous, and the walk would have been uninteresting, had not the bounding ranges exactly isolated the glorious peak of the Combin, which was visible during the greater part of the descent. At 5.15 we reached Notre Dame, which contains a capacious parsonage, where I believe travellers are entertained, but which did not look attractive, and at 7 we passed St. George, a nest of squalid chalets. Just beyond here the mule-track crosses the river and mounts upon the left bank, and on gaining the summit of the ascent we looked down upon the Val d'Aosta. Here I was seized with a slight attack of palpitation of the heart, and had to rest a few minutes; and while Jacomb, Jean Croz, and Luboz pushed on to Villeneuve to get a carriage ready, Michel and I followed more leisurely. It was soon quite dark, but we managed nevertheless to get safely down to Introd; a little below this village we struck into the *grande*

route, and entered Villeneuve at 8.30. Here we found Jacomb in a cabaret, who gave me the agreeable intelligence that no carriage was to be had for love or money; he had been in the first instance to the principal hotel in the town; but the landlord refusing to give him anything to eat or drink until he had engaged a bed-room, he had left the place in disgust. While we were discussing in a very animated manner whether we should sleep at Villeneuve, walk on at once to Aosta, or go there at about three miles an hour in a cart that was offered us at a most extortionate price, a carriage drove up from Courmayeur, with a Piedmontese lady and gentleman inside. They obligingly gave us a seat, and at 10 o'clock we were once more under the hospitable shelter of the Hotel du Mont Blanc.

Leaving Aosta, we crossed the Col des Jumeaux to Zermatt, and then proceeded southwards to Turin, whence we made the first ascent of Monte Viso—two interesting expeditions which are elsewhere recorded in this work. Our paths now diverged, Jacomb taking Jean Croz with him and hurrying off to Mont Blanc, while I retained Michel, intending to move by easy stages homewards. My Alpine wanderings of 1861 were concluded by an excursion on the northern side of the Maurienne, a brief description of which will contribute some additional materials for the physical geography of the Graian Alps.

After an agreeable rest of two days at Turin, I moved up to Susa on the evening of the 2nd of September, and the following day, in order to avoid the uninteresting monotony of the Cenis, I crossed the Col de Clapier, or de Savine, from Giaglione to Bramans, and walked down the great road from the latter place to Modane. Here, as before, I found very fair accommodation at the Lion d'Or, although the resources of the establishment were severely

taxed by the presence in the town of a large body of geologists, about forty in number, including some of the greatest celebrities of France, Switzerland, and Piedmont, who were holding an "extraordinary session," and who had their head-quarters at the hotel. My principal object in staying at Modane was to ascertain the rate of progress being made in the tunnel, and to visit the Col de Chavière and the peak to the W. of it, which I had left unexplored in the previous year. Immediately to the N. of the town a deep ravine leads directly up to the col, and on its eastern side is an alp and a small settlement, called the châtelets of Poleset (pronounced Polsett), and reported to be two hours distant. The morning of the 4th was spent in inspecting the works in the tunnel, and at 4 in the afternoon Michel and I started for Poleset. The path at first zigzags upwards considerably on the E. of the ravine, through a fine pine forest, broken in many places by lofty precipitous crags, and then turning sharply to the westward, emerges on the open alp above. Although we walked very leisurely, we arrived at the principal chalet at 5.30, where we found comfortable quarters, including an excellent hay-loft. A barometer observation at 6 P.M. gives the following results:—

Turin	5,968 English feet.
Geneva	6,048
St. Bernard	6,005
Mean	6,014

We left the chalet at 5.30 on the morning of the 5th, and continued the ascent of the valley, which is far wilder in its scenery than the neighbouring route of the Col de Rosoire. Passing on the left a nearly vertical cliff, the face of which was seamed with waterfalls from a large glacier on its summit, we mounted a succession of barren rock-strewn slopes, and at 8 we reached the Col de

Chavière, now entirely devoid of snow. I immediately set up the barometer, and at 8.15 took the following readings : —

Bar. reduced	548.89 mill. 21.645 inches.
Air temperature 5.0 Cent.	Moist bulb 0.8 Cent.

whence we have : —

Turin	9100 English feet.
Geneva	9161
St. Bernard	9171
Mean	9144

This col is therefore nearly five hundred feet lower than its neighbour, and as the descent to Modane can be made in two hours and a half of tolerably quick walking, there is no question that it affords by far the shortest route from Pralognan, of which indeed a mere glance at the map is quite sufficient evidence. As a point of view, it is well worthy of a visit, as it commands the chain of Mont Blanc on the one side and Monte Viso on the other : the Dauphiné Alps are, however, intercepted by the range on the S. of the Maurienne.

We left the col at 9.15, and climbed some rocks on the W. of it to an extensive glacier plateau above : crossing this, we arrived at the foot of a steep peak of rock, which we scaled without difficulty, and gained its summit at 11.45. It was not, as I expected, a single peak, but one of the teeth of a knotted system of serrated ridges, sending out a number of spurs to the northward, which divide from one another the numerous valleys radiating from Moutiers Tarentaise. Several of the serratures of the ridge next to us on the W. clearly overtopped our position. Exactly at noon I observed the instruments, and the readings were as under : —

Bar. reduced	505.14 mill. 19.897 inches.
Air temperature	4.5. Moist bulb 2.3.

Whence we find :—

Turin	11,461	English feet
Geneva	11,484	
St. Bernard	11,457	
Mean	11,467	

The weather was, as usual, perfect, and the view, as from every other of the Graians, of immense extent and interest. We were now far above the range on the southern side of the Maurienne, and we looked straight over it to the Alps of Dauphiné, which presented an array of peaks and glaciers even more numerous and striking than the opposite chain of Mont Blanc. Of the peaks in the immediate foreground the Dent Parassée was the most prominent. After my previous failures I had not thought it worth while to drag up the theodolite, but I took a sight at this mountain with a pocket-level, and the optic axis hit the peak much below the summit. This, as far as it goes, is confirmatory of Von Welden's trigonometrical determination of 12,137 feet (*Der Monte Rosa*, p. 30). I have no doubt that the Dent Parassée could be climbed without difficulty, and that its ascent would be as full of interest as that of any other mountain in the Graian Alps. While looking round upon the prospect, the Mont Pourri was not forgotten; Michel and I carefully scrutinised the face it presented to us, which was the one flanking the Val Peisey, and as far as we could judge at so great a distance, it gave good hopes of success.

We left the summit at 12.30, and descended directly towards the valley without returning to the col, reaching the edge of the snow-field at 1.30, resting there an hour, and regaining Poleset at 4. We made another halt at the châlet to drink milk, and finally, at about 5.30, we were back at the Lion d'Or. Here I joined the *savans* at dinner, and spent a very pleasant evening with them.

I had noticed during the day's excursion that there was a marked distinction between the rocks on the two sides of the valley leading to the Col de Chavière, those on the eastern side being quartzite, and those on the western schistose beds of a greenish-grey. It appears that the valley of Poleset coincides with the line of a great fault, where strata of carboniferous age, on the western side, are brought up against beds of later date, perhaps triassic, on the eastern.

I would gladly have stayed another week in the western Graians for the purpose of climbing the Dent Parassée, and making a second attempt upon the Pourri; but I had already consumed the time that I could conveniently spare from business, and was obliged to hurry away, after seeing eight-and-twenty geologists start for Bardonnèche, on as many horses and mules, one of the drollest sights I ever witnessed. I went by diligence to St. Jean de Maurienne, whence I took the night train to Paris, and in a few hours arrived at home.

Before parting from Michel Croz at Chamousset, I urged him to try the Pourri from Peisey, and endeavour to discover the proper line of attack; for, however pleasant it may be to make the first ascent of an important peak, it is none the less annoying to drag about a number of heavy instruments, and in consequence of imperfect knowledge to fail in getting them to the top. I am happy to say that Michel acted upon the instructions, and that his efforts were crowned with success. He climbed the peak on the 4th of October, "*par un trajet bien difficile*," starting at 4 A.M. from the chalets of "Entre deux Eaux" in the Val Peisey, and reaching the summit at noon.

CONCLUSION.

It is impossible to travel in the Graians without being struck by the extraordinary discrepancies between the actual structure of the country and the way in which it is represented in maps,—especially in those recently executed under the authority of the Sardinian Government. I shall conclude with a few remarks on some of the errors which have hitherto obscured our knowledge of the geography of this portion of the Alps,—the more important of which I am happily able to elucidate.

On referring to Corabœuf's memoir, to ascertain what he measured as the Aiguille de la Vanoise, we find that the heights of it and the Sassièrè were determined by triangles upon the same base, the two extremities of which were at Belleface and La Magdeleine, in Savoy. I have constructed the Vanoise triangle, and am satisfied that Corabœuf's peak is the Grand Casse. The latitude and longitude which he gives exactly agree with the position of the last-named mountain; and, moreover, in the map of Raymond, and in those attached to the Measure of the Parallel, and to "Le Alpi," the words Aiguille de la Vanoise indicate a peak on the northern side of the col. In the six-sheet map the peak has disappeared, and in the larger map it is called Pic des Grands Couloirs,—a fabricated title, printed across a quantity of shading, which has not the faintest similarity to the actual structure of the chain.

The blunders in the case of the Mont Iseran are still more astonishing. The mountain to which Corabœuf attaches this name was measured from Piedmont, the two

extremities of his base line being at the Superga and Saluzzo. The Grand Paradis is the only peak of the Graians the height of which is at all near that ascribed to the Iseran, and it is very conspicuous from the above stations. I had long suspected that it had been mistaken for it, and on laying down Corabœuf's triangle on the map in "Le Alpi," my suspicions were at once confirmed. The two sides converged exactly upon the Paradis, and not upon Mont Iseran, although the latter peak is shown in its usual position. My friend Mr. Tuckett has performed the same operation on the six-sheet map, but he cannot make the triangle agree with either of the two peaks, and there is no doubt that the map is incorrect. Again, Von Welden, in his list of heights, p. 30, gives "Der Iseran in Savoyen, N.B.," 13,265 English feet; the letters N.B. denoting that he made the determination himself. In the records of Zumstein's ascents of Monte Rosa, contained in a later part of the volume, the Iseran is mentioned, p. 118, as one of the most striking peaks visible from the great Plateau; and I know by actual inspection from the very same position that the Grand Paradis is the mountain in view. Lastly, Mr. Tuckett, to whom I am indebted for calling my attention to the passages in Von Welden, has, by an observation of the boiling-point, determined the height of the Paradis as 13,300 English feet. These figures agree so closely with the two independent trigonometrical measurements of the Iseran, which are 13,271 and 13,265 feet respectively, that the identity of the mountains may be considered conclusively established.

The origin of the blunder is easily explained. Throughout the Alps the word *Mont* is applied to the highest point of a road as frequently as to a mountain. The Mont Cenis, Mont Génèvre, Mont St. Bernard, Mont St. Gotthard, are familiar instances, and many others might be

mentioned. The Mont Iseran is a case of the same kind; it is a col and not a peak. A number of engineers, knowing that there is something in the Graians called by that name, and seeing a high snow-peak in the supposed direction, immediately identify the two; whereupon the Sardinian surveyors perform the astounding feat of moving the mountain bodily out of Piedmont into Savoy, a distance of fifteen miles, and erect it on the side of the col where no such thing exists. They subsequently become alive to the fact that a mountain called the Grand Paradis forms part of the range on the north of the Val di Locana, and in order that nothing may be wanting to complete the confusion, they affix the words Gran Paradiso to two different peaks of this range widely distant from one another.

The way in which the Iseran fiction has penetrated our whole Alpine literature is the most marvellous thing in the history of the Alps. Scarcely one of the many writers who have described any part of the chain from the Pennines to the Mediterranean has failed to mention the Mont Iseran, and the descriptions of it are sometimes exceedingly amusing. The most ludicrous instance of the kind may be found in the geographical introduction to Joanne's excellent "*Itinéraire de la Savoie*," where the author informs us that although the Iseran is not much lower than Mont Blanc, it is so shut in by other mountains that it is scarcely visible from the valleys which open at its base.

The map attached to the measure of the arc of the mean parallel enjoys the honourable distinction of being the only production of the Sardinian Government in which the Mont Iseran is not represented as a peak. The Government surveyors in their subsequent publications appear to have deliberately ignored that admirable work.

One among numerous instances of this is the case of the Dent Parassée, which, although represented in the vignette map of the Roche Chévière, and shown in the panorama taken from that peak, is omitted both in the six-sheet and the ninety-one-sheet maps.

The recent Government surveys, and, especially the large map now in course of publication, appear to be correct as far as the plains and larger valleys are concerned, but when the traveller who uses them arrives among the mountains he is utterly lost. It is evident that the higher Alpine ridges have not been surveyed, and although parts of them may have been roughly sketched in on the ground, it is impossible to resist the conclusion that by far the larger portion have been invented in the office, and laid down upon paper so as to form tolerably picturesque groups. Nor is this all: the nomenclature is frightfully inaccurate, and has probably been partly fabricated, and partly taken down from the lips of the inhabitants by persons ignorant of French. The shortcomings of the Sardinian maps are all the more striking when they are compared with the faultless and beautiful work of the Swiss Federal engineers. I make these observations with the greatest regret, as I would not willingly be thought forgetful of the brilliant services the Piedmontese have rendered to Italy, or of the courtesy and kindly feeling with which they always welcome English travellers. But it is necessary to the progress of Alpine geography that the truth should be candidly stated, and the simple fact is that the recent mountain cartography of the Sardinian Government is a gigantic imposture, and a disgrace to its engineers and surveyors which it will take years of earnest labour to wipe away.

5. TWO ASCENTS OF THE GRAND PARADIS.

By J. J. COWELL, F.R.G.S.

No high mountain in the whole region of the Western Alps has remained in undeserved obscurity so long as the Grand Paradis. This circumstance is the more remarkable, when we consider the great claims to fame which this magnificent peak possesses.

In the first place, it is the highest mountain in Italy. It stands out towards the east, clear from the main range of the Graian Alps, on purely Italian ground, and thus escapes that partition of nationality which renders Mont Blanc and Monte Rosa but half Italian. It is, moreover, very conspicuous from the North Italian plain, owing to its great height and isolated position; and the circumstance of its being in the very heart of the solitary region where the famous *bouquetin*, extinct in all other parts of Europe, still continues to maintain a precarious existence, gives it an additional claim to attention.

Nevertheless, the Grand Paradis remained, until two years ago, almost unknown; and unknown, too, in a peculiar way. It is not surprising that a mountain here or there should experience vicissitudes of fortune, in respect both of its nomenclature and its geographical identity. Some mountains, which undoubtedly have a material existence, are unfortunate enough to have no name (for which reason, of course, I cannot point out an example); and on the other hand, some mountains which undoubtedly have names,—and well-known names, too,—

such as the Aiguille de la Vanoise and Mont Iseran, unfortunately have no material existence. But the Grand Paradis, previously to 1859, suffered from both these disadvantages at once. From Turin, indeed, a distant lofty summit was pointed out as part of the Grand Paradis; but as one approached the place indicated, so little could one see or hear of the mountain that one ceased to believe in its existence. On the other hand, every explorer of the peaks and passes of the Pennine Alps may have observed a splendid mountain to the south of Cogne, whose height and name were a matter of mere conjecture, as may be seen by a reference to the table of heights contained in our previous volume. The prevailing ignorance extended even to the authors of the Sardinian Ordnance Map, who omitted altogether to give the mountain that prominence which it deserved. They avoided the difficulty by freely sprinkling a large strip of their map with peaks and ridges of various shapes and sizes, and then printing "Gran Paradiso" in large letters at each end.

The just description of the mountain may be briefly given. The Cogne highlands are divided from the Pennine chain by the great Valley of Aosta, and the highest crest of the range consists of two branches, which meet at right angles. One branch, the shorter of the two, runs north and south, and at its northern extremity is the famous Pic de la Grivola, which is described in another part of this volume. The other branch runs for some thirty miles west and east, and contains several peaks of great height near the Col de Cogne, even yet unvisited. At the point of intersection of the two branches stands the Grand Paradis, surpassing in height every other part of the range.*

* It has been suggested to me by my friend, Mr. F. F. Tuckett, who pre-

From its foot two valleys descend towards the north into the Valley of Aosta, inclosing between them the Pic de la Grivola,—the Valley of Cogne on the eastern and the Val Savaranche on the western side.

Among the many points of view from which I have seen the Grand Paradis, I should at once fix on the Col du Géant as that from which it appears to the greatest advantage. It is thence seen rising right before the spectator, barring the way towards Italy, and presenting a more imposing aspect than any of its remoter rivals. I saw it thus under very favourable circumstances in 1859, and the idea of exploring it then first entered my mind; but its true name I did not then know, nor could I learn much from my guides, who called it by various local names. Accordingly, I leisurely collected information about it for use in 1860; I say leisurely, because I soon discovered that the sum total of information existing on the subject amounted to no more than this. First, it was not the Pic de la Grivola; and secondly, it was very likely to prove

ceded me in visiting this region, that the popular fallacy which for so long caused the imaginary Mont Iseran to be considered the highest peak of the Graian Alps, may have originated in the vague reports of a very high mountain existing S.E. of Mont Blanc; which high mountain may not improbably have been the Grand Paradis. There must have been some high mountain visible to the many observers who report having seen Mont Iseran, and also to the author of the work quoted below, who actually measured the peak in question.

"*Der Monte Rosa, Eine topographische und naturhistorische Skizze*," Von Ludwig von Welden. Wien, 1824, bei Carl Gerold. The author states (page 30) that he actually measured trigonometrically the height of "Der Iseran in Savoyen," and ascertained that it was 12,456 *pieds du roi* or 13,275 English feet.

It thus appears that Von Welden did observe and carefully measure a summit, which he erroneously calls Mont Iseran. I strongly suspect that the mountain which he did measure was the Grand Paradis, the height of which, as deduced from Mr. Tuckett's observations, differs from Von Welden's results by only 25 feet. The Grand Paradis is certainly at a considerable distance from the supposed site of Mont Iseran,—no less than 13 miles. Still there appears to be no other mountain at once near enough and high enough to have misled a scientific observer like Von Welden.

to be the Grand Paradis. The Sardinian Ordnance Map, from which I hoped to learn something, served only, for the reason above mentioned, to confirm my belief that the mountain was quite unexplored.

Thus it became evident that I must study the mountain for myself before making any attempt to ascend it; and I



THE GRAND PARADIS FROM THE CRAMONT.

fixed upon the Cramont as the best position from which to reconnoitre. Accordingly I ascended that mountain on a beautiful day in the latter part of August, 1860, accompanied by my old friend and guide, Michel Payot of Chamounix, who was to attempt with me the ascent of this unknown mountain. We were distant from it twenty miles, so that we could decide with tolerable precision on the general direction of our future route, although we could not expect at that distance to detect any of those minor features, a knowledge of which is generally of great

value. We agreed that the ascent ought to be made from the western side, along the rocky margin of the glacier on our right hand; and that probably we should find no difficulty until reaching the base of the highest peak, which certainly did look very steep indeed.

This right-hand glacier descended, as we ascertained, into the head of the Val Savaranche, which joins the Valley of Aosta, about six miles above the city of that name. So from Aosta we determined to start. I prevailed upon Jean Tairraz, the landlord of the Hotel du Mont Blanc, to go with me, he having made an unsuccessful attempt on the mountain a few days previously. I was also fortunate enough to obtain the company of Mr. W. Dundas as joint explorer.

We spent three dreary days at Aosta waiting for fine weather: all day and all night we had nothing but wind and rain. In vain we tormented Tairraz and Payot by trying to make them say that they thought it was going to clear, and on the third day Payot began to shake his head, and talk ominously about *cette vilaine cîme*, and the great difficulty—of which I was myself only too well aware—of ascending it just after a three days' fall of snow.

On the fourth day, September 3rd, 1860, we made a start, as the weather did hold up in a sulky sort of way, without actually raining, but with evident preparations for several more wet days at a moment's notice. Snow was lying everywhere above the level of 6000 feet, and the air was very cold. Still we were thankful for the day such as it was; for in that most inclement autumn of 1860, Alpine travellers were compelled to accept as fine any day which passed without a storm.

We first ascended the Valley of Aosta, passing on the left the mouth of the Valley of Cogne; and then crossing the Dora at Villeneuve, we travelled due south up the

Val Savaranche, along the western slope of the Pic de la Grivola. The lower part of the Val Savaranche is grand and gloomy, and seemed to us almost oppressively dark under the heavy shade of the threatening storm clouds; but the upper half of the valley is flat, uninteresting, and singularly bleak and bare.

Our attention was chiefly directed to the conspicuous traces of glacier action, both on the sides and in the hollow of the valley. The numerous and extensive groups of "*roches moutonnées*," extending for several miles, deserved much more careful observation than we were able to bestow. We were compelled to hurry on to the Châlet du Mont Corvé, where we were to sleep, and whence we expected to make a survey of the mountain before sunset, and ascertain whether or no it really were the Grand Paradis.

After tramping steadily along the valley for seven hours, we turned to the left and began climbing a precipitous path which led to the solitary châlet and dreary pasturages of Mont Corvé. This final climb occupied an hour, and tried us severely, heavily laden as we were, and compelled at times to creep on all fours along wet mossy ledges of rock.

The man at the châlet received us very civilly, having been forewarned by Tairraz of our visit; and having plenty of room inside, he was able to make us more comfortable than I expected. Comfort, I must observe, in an Alpine bivouac is not a mere matter of luxury, but is of real importance; the man who has had a comfortable night in a warm bed, and a comfortable breakfast before starting, will do much more work and enjoy his day much more, than one who has passed a cold restless night, however hardy and enduring he may be. Thus, although a bivouac and a night spent in a châlet are most

enjoyable in themselves, yet they prove, as far as my experience extends, but bad preliminaries to hard work. The days on which I felt most confidence in myself, and on which my powers of enjoyment were keenest, were not those which succeeded nights spent in a *châlet*, where one is generally cold and always restless. We were, however, very glad to see that we were to have plenty of room, of hay, and of spare blankets.

The remaining hour of daylight was spent in examining the high peak to the east of us, which we supposed to be the Grand Paradis. On comparing it with my sketch and our maps, we were unable to reconcile them with the scene or with each other; and we ended with the conclusion that, though we could not tell where we were, at any rate a high mountain was before us, and we had to find the way up it. Two large glaciers descend from the foot of the highest peak,—one that of Montandéni, flowing northward, and the other that of Mont Corvé, flowing westward. Between these two, lies a small glacier known as the Glacier de Lansqueour. It terminates at the snow-line, whereas the other two descend into the valley. The glaciers are separated by ridges of rock, and scattered heaps of enormous *débris*. We determined to ascend by the ridge on our right hand, which lies between the middle and right-hand glaciers, and which we thought might prove to be the same which we had fixed upon from the Cramont.

During supper we tried to learn from our host something about the geography of the surrounding region; but he could tell us nothing. His father and grandfather before him had occupied the *châlet* for 105 years; yet they had no name for this mountain, and seemed never even to have gone as far as the foot of the Glacier de Lansqueour.

We were afraid to say much about the state of the

weather, lest we should discourage each other before our time; but we knew only too well what to expect. At length, after we had been pretending to sleep for some hours, we began to feel an occasional drip, drip, through the loose and draughty roof.

In the morning of Tuesday, September 4th, it was snowing fast, and so the guides did not call us till nearly seven o'clock, when the weather began to clear a little. At 7.30 we started up the long desolate slopes above the *châlet*, which extend to the end of the *Glacier de Lansqueour*. After an hour's walk in the snow-storm, we reached the base of the high rocky barrier which stretches from the *Glacier de Lansqueour* to that of *Mont Corvé*. Every exposed surface of rock was coated with ice and sprinkled over with snow, so that in creeping along the ledges we had to go slowly and cautiously. After an hour's scramble we reached a level plain of snow,—hard snow, as we were delighted to find. We had now ascended above the snow-storm, which appeared not to have extended to this region. There had been fortunately a hard frost, so that the masses of fresh snow which had fallen during the preceding week were completely consolidated, and as hard as old well-compacted *névé*. We were thus relieved from all apprehension on the score of avalanches, which might, at times, render the summit inaccessible.

After a little more rock-climbing we fairly entered upon the steep snow-slopes that lead up to the base of the lower peak. The surface here was very hard, and we could not step firmly on it without a fatiguing effort, as many of the nails had been torn from our boots during our scramble among the rocks. So, to our regret, it became necessary to submit to the delay occasioned by cutting steps. However, Payot wielded his axe with great rapidity, always cutting a good step at one blow.

He cut about 700 steps in two hours, which is certainly very fast work.*

We now passed above and beyond the source of the small Glacier de Lansqueour, and found ourselves upon the broad arête which separates the sources of the two large glaciers. On our right the arête fell away, forming a precipice that overhangs the Glacier du Mont Corvé; but on our left the head of the great Glacier de Montandéni was almost on a level with us. It lies in a long and nearly level channel in the depression between the highest and the lower peaks. This long channel Tairraz named the Corridor, from its resemblance to the Corridor on Mont Blanc. We reached it in four hours from the châlet.

From this position we could see the Cramont, and we now succeeded in reconciling our sketch with the visible features of the mountain. The three glaciers, the two sharp peaks, and the gap between them were all satisfactorily identified. We saw that the actual summit was not, as it had appeared to us, a sharp point; it was — to use a familiar illustration — the gable-end of a nearly horizontal roof, the ridge of which had lain exactly in the line of sight.

Along the western base of this highest ridge, which is about 500 yards long, runs the corridor, about 1500 feet below the summit. The southern and lower end of the ridge rises from the corridor with sharp slopes, and the northern end with vertical cliffs of ice, of 200 or 300 feet in height, above which those steep slopes which we had seen in profile from the Cramont lead up to the summit. Just below this point these slopes have an inclination of 57° .

* It must be understood, however, that these were mere superficial indentations into the crisp snow, which yields readily to the axe. Cutting a secure step in hard ice is a very different matter, requiring ten or twelve blows, and occupying a minute or more.

and elsewhere they vary from 50° to 45° . All along the side of the slope, and about 150 feet below the crest, runs a small crevasse three or four feet wide.

We did not propose to climb straight up the slope, which appeared too steep, and we therefore proceeded towards the southern end of the corridor, intending to advance thence along its whole length, mounting slowly all the way. From the point where we recommenced cutting steps, we had, in order to reach the summit, to travel about 500 yards and to rise 1000 feet; and as we observed that the latter half of our route would extend above the precipices overhanging the corridor, we tied ourselves together. About the advisability of doing this Tairraz had some doubt, bearing in mind the fatal accident to his brother, Victor Tairraz, which had taken place only a fortnight before on the Col du Géant; on which occasion the rope had (as he imagined) proved the destruction of the party. We discussed the question, and Dundas and I overruled Jean Tairraz — fortunately for him — as the sequel will show. We considered that, while a single man who might fall could have no chance of saving himself, it was very unlikely that one man by slipping could pull us all down, as our whole party were experienced and sure-footed. My own experience on this question of roping leads me to conclude, that if all the party are practised mountaineers, the use of the rope on a slope or arête conduces much more to safety than to danger; while if some of the party are unpractised, or temporarily unequal to their work, no possible precautions can prevent all chance of an accident.

As we ascended we found that the weather improved, until there was not a single cloud to be seen above us. But at the same time we became conscious that this change was owing to a violent north-east wind, which had

cleared the upper regions of the air, and which now swept fiercely down the side of the slope, chilling us thoroughly, and threatening to make a prolonged stay on the summit intolerable.

At last, after 400 steps had been cut, and we had been an hour and a half on the slope, we reached the little crevasse of which I have spoken. Had we met with this on a level or slightly inclined surface, we should merely have stepped over it; but as the slope at this place had an inclination of 51° , the upper edge of the fissure was three feet above the lower edge, and almost overhung it. Both edges were rather rotten, but, by help of one or two deep notches, we pulled ourselves up. But while Jean Tairraz, who came last, was half way up, with his foot on the lower edge, and his knee on the upper, both broke off under him, and he at once rolled over on his back and went down the slope headlong. Dundas, who was next him, shouted to us to "hold on," and we dug our spikes desperately into the hard surface, and Payot struck in his axe-head, in readiness, as he said, to hold us all up if necessary. However, no such necessity arose; for Dundas, by simply standing firm in his tracks, and without seeking much support from his pole, arrested Tairraz's rapid descent with the rope when he had gone down about twenty feet, and drew him up again without any assistance from us; so that, had Dundas been alone, he could have saved him without difficulty. But had Tairraz not been tied, the issue would have been very different. He was shooting down head foremost, quite unable to stop himself with his alpenstock on so hard a surface, and would in a few seconds have met the fate of his poor brother Victor. I believe nothing could have saved him from glissading to the bottom of the slope, and then falling sheer over on to the Glacier of Montandeni.

We were so miserably cold that we could not stop to talk,—in fact I do not think a word was said. Payot resumed his work, and in a few minutes we stood on the top of the arête in a little gap, to the north of which rose the summit. Here we met the full force of the N.E. wind, and the cold became so intense that we felt that we could not endure it much longer. So with fifty more steps we mounted the last and steepest arête of ice, and reached the crest of the highest ridge, when we at once took refuge behind a little turret of rock,—being in a state of thorough wretchedness, and thinking about nothing but how to descend at once.

We should have started without a minute's delay but for the alarming discovery that Payot's hands were frozen, which, till then, he had concealed from us. How he had been able to cut those last steps I could not imagine; for now he could no longer hold the axe, which he nearly let fall over the precipice on the Cogne side. His hands were really in a dreadful state, the backs of a livid purple, the palms quite white, and the whole curled round, and stiffened as they had been grasping the pole. Tairraz also was partly disabled by a misfortune that is of not unfrequent occurrence in very cold weather. During a long ascent the foot is constantly bent upwards, and the thick boot becomes frozen quite firmly in that position, so that the torpid foot has not sufficient muscular energy to bend the sole downwards, which it is absolutely necessary to do before one can step downhill. Thus Tairraz could not possibly descend without first reducing his boots to subjection. So while he and I each took a hand of Payot's and pinched, rubbed, and thumped them violently, Payot and I each stamped with equal good will on Tairraz's toes; until after about five minutes' hard work, their nervous twitchings showed that they began to feel that ex-

cruciating but most welcome pain, which announces that all danger of a permanent frost-bite is over, and that animation is being restored.

However, they declared that to complete the cure, and to warm us properly, a rapid rush down was indispensable. So we detached ourselves from the rope, as otherwise in a rapid descent we should have pulled each other over, and they all started off, while I remained a moment to look at the time and to observe the thermometer. This had been in my waistcoat pocket, with my coat closed over it, and the sun had been shining brightly on us; yet it stood at 22° , so the temperature of the air may be imagined. In a moment more I was hurrying down after them, and we descended the slope at full speed, scampering furiously down where we had crept up painfully and cautiously. To a spectator our descent would have appeared a wild, disorderly flight, like the stampede of a prairie-herd fleeing from the fire behind, and rushing down a precipice in front. In fact, the cold had quite demoralised us, and, as sometimes happens, the spirit both of enterprise and prudence had yielded to the pressure of intolerable physical discomfort; and so, powerless to resist, we fled from our enemy as if panic-struck. As soon as we could do so with safety, we glissaded about 500 feet right down into the corridor.

The ascent of the arête had occupied us for two hours; we came down in eight minutes, thoroughly warmed and invigorated by the excitement of the descent, in spite of the continued inclemency of the weather. Our return journey was most luxurious, as we glissaded nearly the whole way, and thus avoided the tedious passage over the rocks. We got back to the chalet in three hours after leaving the summit; so we had been absent but nine hours altogether, having taken six hours to ascend and three to

return. Now, considering the great height of this mountain, and that one can get up it without ever touching a glacier, with little fatigue and no danger, and all in nine hours, I think it one of the most easy and luxurious expeditions that can be made.

It was true that we were rather dissatisfied. We grumbled to each other all the afternoon, — we had been very unfortunate, — we had seen nothing from the top, and had taken no observations. We had spent two days in climbing to that summit, and had after all experienced, in spite of the fine clear weather and a bright noon-day sun, the fate so beautifully described by Byron * : —

“ He who ascends to mountain-tops, shall find
The loftiest peaks most wrapt in clouds and snow ;
He who surpasses or subdues mankind,
Must look down on the hate of those below ;
Though high above the sun of glory glow,
And far beneath the earth and ocean spread,
Round him are icy rocks, and loudly blow
Contending tempests on his naked head ;
And thus reward the toils which to those summits led.”

On the following morning Dundas was obliged to return to Aosta, but I determined, as the day was really very fine, to ascend the mountain again with only Payot. As all the steps were ready-made, we ascended very rapidly, reaching the top in five hours from the *châlet* ; rising in that time 5500 feet, or 1100 feet per hour. Thus, in facility of rapid ascent, the Grand Paradis surpasses the well-known Cima di Jazi, and is 1000 feet higher. To please Payot, I counted carefully the number of steps that he had cut the day before. The grand total was 1275, a score of which he was not a little proud, it being, he said, the greatest number that had ever been accomplished by a Chamounix man in one day.

* “ *Childe Harold*,” Canto iii. Stanza 45.

The actual summit consists of a thin cornice of ice, and we found it impossible to establish ourselves there; so we took up our position at the rock which had sheltered us on the previous day. This is a little square turret, about fifteen feet high, and it projects from the face of the cliff on the Cogne side, like an upright tower projecting from the sloping wall of a fortification. But even here there is not room for more than three, or at most four, men to sit; a larger party would have to make itself at home on a slope with an inclination of 57° . In fact, we had to be very careful how we moved, and never let go our hold upon the rock; for there is no flat place to stand on — not a square foot anywhere.

After three observations of the boiling point* of pure water, I found the mean temperature of boiling water to be 188.1° . The height of the Grand Paradis, deduced according to Colonel Sykes' Tables, would be 13,700 feet, which is probably too high an estimate by at least 200 feet.

At any rate, we could see quite over the top of the Grivola, and by measurement made it to be 500 feet lower than ourselves.

The unknown regions to the south-west, which we were intending to explore, we scrutinised carefully, comparing the view with our maps. We saw peaks in unexpected plenty, twenty or thirty being more than 12,000 feet in height. We could identify only two, — the Levanna and Mont Pourri, — which bore W. by N. But there were others higher than these, which we could not make out, partly owing to our ignorance of their distance, and partly through the inaccuracy of the map. I could not even fix our own position on it; the more I studied it, the more I

* The observation in detail was as follows:—Date, September 5th, 1860, 1 P.M. Temperature of air in shade, 51° ; temperature of boiling water, 188.1° . Contemporary observations at Turin give us, temperature of air, 78° Height of barometer, 28,977.

became perplexed, as ridge, peak, and glacier were all in confusion. Thus I had to fix our position without reference to the map; and having no means of ascertaining directly either latitude or longitude, I took bearings from all the well-known mountains in the Pennine chain.*

The few pinnacles of rock which rise from the long icy ridge are of mica-schist, partly disintegrated, and covered with black and green lichen. These rocks are strangely riven and broken up, and everywhere present a decayed and crumbling aspect, as if the destructive agencies of nature were rapidly overpowering them. Our own little turret appeared ruined to the last degree; it was in two places split from top to bottom, and the whole material was so friable that fragments as large as bricks could be detached with a slight touch. Payot even objected to my climbing up it, lest it should collapse, or in his very expressive phrase, "*dégringoler*." And indeed, I believe, that in a few years it must fall to pieces; so that, as the adjoining rocks are no doubt liable to the same disaster, the height of the mountain is being slowly reduced.

I mounted carefully on to the top of the turret, which was quite level, and about half the size of a card-table; from here I obtained a much better view. Everywhere the valleys were choked with clouds, and nothing was visible below 7000 feet. This is a circumstance not always to be regretted, as to my mind it seems that one is much more impressed with a sense of the sublime by being thus raised above every trace of the inhabited world, and compelled to gaze only upon the beautiful but barren peaks that rise above the works of man, and on the "unfruitful" sea of mist that surrounds them all. Owing to my isolated

* From these bearings I should place the summit of the Grand Paradis as follows:—North latitude, $45^{\circ} 30' 24''$; West longitude, $7^{\circ} 15' 12''$.

position on the point of rock, I was peculiarly liable to be thus impressed. The clouds 2000 feet below were beating against the sides of the cliff over which I stood, so as to suggest the idea of a bottomless precipice. It was a strange and exciting sensation—that of being alone on this little spot, lifted so high in the air above all surrounding peaks, and with no visible surface or support below. Looking over the dim mist at my feet, I felt as if perched on the very topmost pinnacle of the universe.

I found my anticipations of a splendid panoramic view fully realised. We were in the centre of that vast semicircle, in which the south-western Alps sweep round from Monte Rosa to Monte Viso, and with no high summit near us to intercept the view. I know of no other point of observation at once so central and so commanding. The whole of the main range, 150 miles in length, is within a moderate distance of the spectator, while the view of the range of Mont Blanc, distant twenty-six miles, is equal in grandeur to that obtained from the Buet. Our view towards Italy ranged over an unbroken surface of cloud from Monte Viso to the Ortler Spitz. These two conspicuous mountains, the black cone and the white, more than 200 miles apart, seemed to me to complete the picture. Beyond them everything was lost in the hazy distance, and thus they rose from the sea of cloud like two great landmarks facing each other, and serving to fix the limits of the visible world.

I repeatedly searched with my telescope for bouquetins on the slopes of the Paradis and the crags of the Grivola (where a troop of five was seen in 1859); but in vain. I hear that there was also a marked scarcity of chamois in 1860 in the Cogne district, while on the western slopes of the Graian Alps they were unusually plentiful. On the Col d'Iseran, a few days afterwards, I saw a troop of thirteen.

Before descending we emptied our last bottle of wine to the health of the King of Italy, whom Payot still honoured as his sovereign, in spite of having been "annexed" some months before. The toast happened at an auspicious moment; for about that same time, in the afternoon of that same day, September 5th, Francis II. fled from his capital, and thus at the earliest moment that the King of Italy could fairly claim that title, his health was proposed for the first time on the summit of the highest mountain in his dominions.

I hope I may have had the good fortune to interest some of my readers in this remarkable mountain. The mere ascent would be perfectly practicable for ladies; but of course the discomfort of the *châlet* must to them prove a great objection. But if any mountaineer has an inexperienced friend to initiate into the mysteries of Alpine climbing, or any youthful *aspirant* to train up in the way he should go, let him start with a six hours' ramble up the Grand Paradis. Nothing could more encourage a beginner than for labours so slight to earn so rich a reward.

Any one who wishes to make the excursion should not go later than the end of August, because the *châlet** is deserted early in September. After bad weather he should make a point of allowing one clear day for the snow to harden, as otherwise he would find the final slope dangerous, and perhaps impracticable. Four days later, after constant bad weather, I saw the slope from the top of the Levanna, and I observed that it was completely striped with the tracks of avalanches. It would be well not to go with a large party; for there is next to no room on the top, which, indeed, is the only dangerous place in the whole

* The *châlet* is at a height of 8200 feet.

journey. Being there is ten times more trying than the getting there ; unless, indeed, the more adventurous climber can mount on to the ruined turret, where there is just room for one person, and he can sit down very comfortably, with his feet over the edge, and survey at his ease the most magnificent of Alpine panoramas.

CHAPTER XII.
THE GLACIERS OF NORWAY.



A VISIT TO THE JÖKULS GLACIER.

THE JÖKULS GLACIER.

BY JOHN FREDERICK HARDY, B.D.

IT was on an unsettled, lukewarm sort of day, in the middle of July, 1859, that three Cambridge men, E. W. Blore, H. Watkins, and the writer of this paper, arrived at Talvik, a Norwegian village, in lat. $70^{\circ} 6'$, with the intention of spending a week there or thereabouts in search of salmon and scenery. Villanous weather had driven us back from Hammerfest, and we were weak enough to hope that, by waiting a few days, we might secure a clear sky for the North Cape at midnight. At all events there was one object of attraction in the neighbourhood,—the great Jökuls glacier,—to visit which would occupy three days, and of whose charms I had heard much, and perhaps talked more, during our voyage northwards. I had asserted that it was the only glacier in continental Europe which actually touched the sea; and although my companions had more than once called my attention to certain specimens in the Lyngen fjord which seemed to contradict this statement, I was enabled to prove to them, as we drew nearer, that these parted with their frozen character, and became actual flowing rivers, some two hundred yards before they reached the sea water, while in the Jökuls there was to be no *hiatus valde deflexus* between ice and ocean.

Our first step on reaching Talvik was to inquire of our host as to the character of the expedition we contemplated;

and learning from him that the route lay over a snow-field, through a bog or two, and across half a dozen bridgeless rivers, we rapidly came to the conclusion that ponies would be the right thing, and requested that three beasts and a guide, who might ride or walk as he pleased, should be ready to start at seven o'clock the next morning, fancying that, as it was now just noon, we had allowed ample time for making these arrangements.

"Ah! but, sir," quoth our host, "we have to catch the ponies."

"Well, surely that may be done before to-morrow morning?"

"I do not know, sir; we have not seen them, nor heard anything of them for a long while."

As this was our first year in Norway, we were rather astonished at the apparent indifference with which our landlord treated the existence of his live stock. But on further questioning he explained that, with the exception of one or two engaged on the farm, all his horses had been sent to the mountains to seek their own subsistence during the summer months; and that, though they would readily yield up their liberty to any one who was fortunate enough to come in sight of them, yet as they might be anywhere within a circle of from fifteen to twenty miles' radius, the chance of an early find was not remarkably great.

He, however, kindly promised us that, should the herd not turn up in two days, he would mount us to the best of his ability from the farm; "and meanwhile," said he, "I trust you will be happy in my house."

In the northern villages of Norway there are no inns whatever; but the chief merchant of the place, who is always wealthy, and generally well educated, is required by the government to receive into his house all respectable travellers, who stay as long as they please, occupy such

rooms as there are to spare, board with the family, and, in short, become an integral part of the household during their sojourn, paying on departure but a bare equivalent for these advantages.

The two days passed away, and still no news of the horses. Watkins, the fisherman of our party, had, notwithstanding bad weather, landed a fine salmon and a few large trout; and being somewhat enamoured of the river (which, though small, was free, and apparently well stocked), was much inclined to rebel against the Jökuls excursion altogether. But towards evening it was finally settled that we should start at eight on the morrow, with the three farm ponies and the guide, Edward.

Our first day's journey was to terminate at Sœpnes; but we were to diverge slightly from the direct route in order to visit a nameless river, which, according to our information, rose full-grown from the earth, instead of passing through a preliminary course of babyhood.

Eight o'clock came, but no ponies; neither was there sign of Edward, or of any other living creature, save the three strangers, who, having eaten the breakfast they found upon the table, and taken a few whiffs of the Brodie-abused narcotic, were beginning to grumble at the mysterious absence of everybody, when Watkins suddenly exclaiming, "Holloa! look, there's a row of some sort going on," pointed out a large and busy crowd collected on the beach, about three quarters of a mile distant. On hastening to the spot, we found that a large shoal of fish had entered the bay in the early morning, and that all hands, including both of Edward's, were engaged in making the most of this piece of luck, by the clever management of an enormous drag-net, which we were glad to see filled almost to bursting as we came up.

Everything must come to an end, and so at length did

the shoal. We returned to the house, got the ponies saddled, and started. Our first start, however, was a false one, owing to the eccentric conduct of Blore's steed, who utterly refused to go in the right direction. Brute obstinacy so far won the day, that Blore decided on walking, and handed over the pony to Edward, to whom, as a fellow-countryman, he at last submitted; but throughout the day his aberrations from the path of duty were manifold.

On leaving Talvik we passed through a copse of alder and birch, and emerged upon a pretty little lake, along the shore of which we crept until it terminated in a blank wall of rock, when our ponies, of their own accord, walked straightway into the water, just giving Blore time to mount the last one *en croupe*. Onwards we splashed, and floundered among the huge stones that formed the bottom of the lake; at one moment the fetlocks of our steeds barely covered, while at the next we were obliged to throw our legs up in the air as they plunged in up to the girths. After a few minutes a break in the rock introduced us to a narrow path, which, leading upwards through thick under-wood and over marshy ground, formed our route for the next two hours. Nothing was to be seen, but much to be felt; for the mosquitoes were outrageously active, and seemed to revel in the blood of an Englishman quite as much as the veriest *gourmet* among ancient giants. However, as we rose, the ground became drier, and our assailants less numerous, till they almost entirely disappeared on our entrance into a pine-wood, in which the trees were small, but very thickly planted, and where my bad riding nearly caused me an ugly accident. Cantering carelessly along among these young trees, I suddenly felt a smart tap on my right knee, and found myself lifted out of the saddle before I could disengage my left foot from the cumbrous

stirrup. Happily I had not lost the rein, and could just reach the ground with my right foot, so that I could manage to wait quietly till Watkins turned back to liberate me; but had my pony been restless, my left ancle must have been snapped, and the Jökuls glacier would have remained unvisited.

Another two hours and we were above the trees, and seated by the side of a small stream, with the waters of which we tempered the contents of our spirit-flasks, and washed down the biscuit and uncooked reindeer-tongue, which were our only edibles. A dreary ride over bog and moor, intersected by dingy streams just shallow enough for the ponies to ford, with the clouds sometimes above, sometimes below, but oftenest in the midst of us, with long stretches of valley beneath, utterly devoid of beauty or interest, brought us to the edge of the snow-field. But, alas! how different from the snow-fields of central Europe. Guarded by no array of massive peaks or splintered aiguilles, trenched by no blue crevasses, pierced by no thundering moulins, this Norwegian snow-field was but a vast expanse of snow, of almost unbroken surface, and with scarcely perceptible change of inclination. Once, as we approached a slight rise, we fancied we saw crevasses, but as we drew nearer the illusion vanished; they were but breaks in the snow-drift, magnified by the mist through which we saw them.

The monotony of our route was varied by the appearance of a large herd of reindeer, which trotted up to within a short distance, halted, gazed their fill, and with a grunt, which might mean either approval or the reverse, turned round and cantered solemnly away. Somehow they looked far more stately and noble than their brethren, to whom we had been introduced a week or two before at Tromsö, and who had long had the advantage of the

humanising influences of their masters, the Lapps. We saw also a good deal of red snow, with which phenomenon we were somewhat disappointed. Students of natural science tell us that the appearance is produced by a lichen, or rather, I believe, according to the latest discoveries, by *infusoria*, whatever that may happen to mean. I am not scientific, and can only say that I have known the same brilliant effects of colour produced in Switzerland by the accidental spilling of a little claret on the snow; and but for the improbability that any pilgrims had preceded us across the fjeld that morning, I believe the *vinous theory* would have been unanimously adopted.

A scarcely perceptible col was reached and passed, the snow was left behind, and we descended rapidly over moorland thickly bestrewn with huge masses of granite, across mountain streams of considerable breadth and power, through belts of vegetation that distinctly marked our progress downwards, till we reached a grass slope so steep and slippery, that we were compelled to leave our saddles and lead our ponies carefully to the bottom. There, shut in by trees and edged by moss and wild flowers, lay the basin source of the river we had come to see. This basin was semicircular in form, with a diameter of about five and thirty feet, from which the river swept away in an uninterrupted course. At first sight the water seemed to rise *en masse* from the earth, but on closer examination three distinct springs were discernible, whose steady flow filled the whole basin with surging waves. I made one or two efforts to sound these springs by the aid of a heavy mass of rock attached to the Alpine rope I carried with me; but the upward force of the stream was far too powerful: my neat little plummet scarcely disappeared beneath the surface before it was tossed up again, like a cork, by the rising water, and carried away to the farthest extent of the line.

We could get no satisfactory information from our guide as to the variation in the flow of water produced by the seasons or by changes of weather ; but it was delightful to witness the anger and contempt with which he received the theory, started, I believe, by Blore, that the real source of the stream was probably much higher up, and connected by an underground passage with the springs before us. Appeasing his wrath by a prompt withdrawal of the offensive hypothesis, we rode on over marshy meadows, with steep hills rising on both sides, to half-a-dozen sheds, which were dignified by the name of Bognelvdal. Here we left our ponies in the care of Edward's father, who was the proprietor of one of the sheds ; and pushing off from a shore strewn with bones, and redolent of decayed and decaying fish, were quickly rowed across the fjord to Sæpnes.

We received a hearty welcome from our merchant-host, who was a very agreeable German, and who gave us an excellent supper of good *white* bread — no ordinary luxury, — boiled-beef, and coffee. The parish priest of Talvik, being already his visitor, occupied the best bed-room, and we ascended about midnight, or what would have been midnight if there had been any night at all, to a mysterious chamber among the rafters. Here two beds were rapidly converted into three, by the simple expedient of taking a mattress from one and a sheet and blanket from the other, and depositing the abstracted property on the floor ; and we were soon all three “in the arms of Porpus,” from which, at the expiration of seven hours, we were somewhat rudely snatched by the mottled arms of a red-headed damsel, who shook us into consciousness, and then administered coffee.

A bathe in the fjord, followed by a good breakfast, formed an excellent prelude to the day's work, which we decided to perform on foot. The first part of our road along the beach was very pleasant, except at certain spots,

where the atmosphere was rather too heavily charged with essential oil of fishes,—a perfume which, I believe, is never very grateful to English noses, though to those of pure Norwegian origin it is too suggestive of wealth and prosperity to be other than agreeable. On leaving the beach, at the head of the fjord, we struck into a grass road between low hedges, which brought us to the hamlet of Alteidet. From this point we lost all trace of a regular path, but pushed our way across a wild tract of moorland, plentifully besprinkled with boulders of every size, and intersected by numerous tiny streams, which occasionally widened out into dirty little lakes, about whose slimy edges crowds of wild-fowl and plover piped melancholy music.

After four hours' walking we reached the heights looking down upon the Jökuls fjord, but a long bend towards the north-east prevented our getting even a glimpse of the great glacier. Towards the south, however, we had a beautiful view of the mountains which line the sides of the Quenanger fjord, and which, though of no great height, form, with their jagged peaks and broken outline, a most favourable contrast to the ordinary flat ridges, or rather table-mountains, of Norway.

Descending to the beach, we could see neither man nor boat, and for some little time our farther progress seemed doubtful; till at length Edward's eyes picked out a Finn cottage, only a few hundred yards distant, but which, being nothing more than a pile of stones (ultimately discovered to be hollow), had not attracted our attention. Inside the Finn cottage was a Finn man, and a little below, hidden by another pile of stones, was a Finn boat; and both man and boat were at our service at the first mention of coin. The boat was flat-bottomed, about four feet wide in the centre, and tapering very gradually to the ends. The planks which formed the sides were neatly sewn together with strips of

reindeer skin, and were curved in some peculiar way, so that the ends were three or four feet higher than the centre. Rudder there was none, and the oars were short, and shaped like shovels. Our *crew* was taller than most of his countrymen, bright-eyed and intelligent-looking, but very dirty and redolent exceedingly.

The afternoon had fortunately turned out bright and warm, and the water was clear as crystal. We looked straight down upon the huge masses of rock which lay at the bottom, and which were probably some thirty or forty feet beneath. Great streamers of seaweed of the most fantastic forms and of the most brilliant colours stretched themselves in every direction, while the sea was alive with magnificent specimens of the jelly-fish, bright with prismatic hues. On each side of us rose precipitous cliffs of basalt and porphyry, broken here and there by ledges, on which the snow lay deep, and solitary reindeer picked their way.

A sharp crack and a low muttering roar told those of us who were familiar with the ways of ice that we were nearing the glacier, who was giving utterance to his just complaints against the tyranny of the summer sun. A few more strokes with the paddles and the corner was turned, and there, full in view, though still a mile off, lay the object of our journey; and seldom had journey a worthier object. Though greatly inferior in size to the frozen rivers of central Europe, the Jökuls glacier is singularly beautiful in form and colour. High up as we could see, its sharp pinnacles cut clear against the blue sky, and the dark red masses of rock, that formed its banks, lent an exquisite brilliancy to the white and azure of the deeply-crevassed ice, the lowest edges of which were washed by the pale green waters of the fjord. The absence of all fragments of rock and of anything approaching to the nature of a moraine gave a

peculiar charm, especially in the eye of one accustomed to the dark lines of the Gorner, or the sooty features of the Zmutt; while the familiar sight and sound of the ice-pinnacles snapt by the heat, and crashing downwards in a thousand splinters, brought to mind many a happy day spent in more southern lands.

Steering our way amongst the miniature icebergs which now crowded the sea, we landed on a low ledge of rock, and clambered up on to the ice, where we spent some considerable time in wandering among the crevasses, and diving into the bright blue caverns, the beauty of which suffered nothing from a closer acquaintance. The upper part of the glacier is inclined at a much greater slope than the lower, and falls of ice-blocks from it were very frequent; but the path by which these descended was so steep and rough that they were reduced to mere splinters by the time they reached us. The lower part is spread out in the form of a fan, not unlike the termination of the Rhone glacier, and great masses of its lowest extremity continually detached themselves and floated gently away. As the year advances, larger portions of the glacier's base are washed away, and the distance through which the blocks fall is consequently much increased,—an altered arrangement, which might possibly cause the propagation of considerable waves. I am much inclined, however, to suspect exaggeration in Von Buch's statement, "that the waves so produced frequently overflow the huts of the natives,"* not only because those huts are built high above the water-line, but on account of the peculiar shape of the glacier.

Disintegration was proceeding rapidly, and it was manifest that the bed of the glacier would very shortly be exposed at the junction of what I have called the upper

* See Forbes's "Norway and its Glaciers," p. 78.

and lower portions, leaving a large space bare of ice and very nearly level. All blocks, then, that were detached from the upper portion, would be so shattered by their fall upon this bare rock, that their fragments would be incapable of producing any great disturbance when they ultimately rolled into the water; while the height of the lower portion above the sea-level is too inconsiderable to admit of the idea that waves of any enormous magnitude could ever result from its disruption.

I was extremely anxious to ascend the rocky banks of the glacier in order to examine the snow-fields above, which are said to occupy a very extensive tract of table-land; but it was clear that this, if possible at all, would be the work of some hours; and, remembering that we were at least seven hours from Sjøpnes, which was again to be our night quarters, and that our provisions were wellnigh consumed, we were compelled to relinquish the idea. Reluctantly resuming our seats by the side of our Finn friend, we bade farewell to this beautiful scene, and were soon making rapid progress homewards. After helping him to get his boat up the rocks to the neighbourhood of his hut, we were on the point of taking leave, when he produced a board about three feet square, and a piece of chalk, and requested us to record our names and country, laying great emphasis upon the latter, as we were the first Englishmen he had ever seen. We of course filled up this neat little *carte de visite*; and having increased his worldly wealth by half a dollar and a pinch of tobacco, shook hands (a ceremony of dubious advantage), and started at a brisk pace across the moor.

Nature seemed now of opinion that she had done all that could possibly be expected of her in giving us a fine afternoon while on the fjord, and that we ought to look for no further consideration from her. The wind rose,

the clouds gathered rapidly, and within an hour a pelting rain set in, which lasted through the night. A love for glaciers, and a mania for wandering to and fro upon the earth, have not entirely destroyed an original tendency of my nature towards *gourmandise*; so when we reached Alteidet, I took the precaution of sending Edward forward to warn our landlord of our approach, and to request that the best possible supper might be prepared. Most satisfactory was the result: though weary and drenched to the skin, the sight of Herr Berger's pleasant face, the agreeable odour which proceeded from the kitchen, and the prompt imbibition of some excellent rum, soon restored our energies, while the intelligence that there was to be bottled stout at supper drove us into a state of wild hilarity. Hastily making such changes in our apparel as our limited wardrobe rendered possible, we sat down to such a supper of rumpsteaks, roast potatoes, and London stout, as would have filled with bitterest envy the soul of that "plump head-waiter at the Cock," of whom the laureate hath penned so pleasant a legend.

Good work and good food command good sleep. We woke to a misty, drizzling morning, breakfasted well, bought an extra wrap or two, in the shape of worsted comforters, of our kind host, and parted, mutually well pleased. Crossing the fjord to Bognelvdal, we regained our ponies, and, discharging after some angry words a disgracefully heavy bill for their board and lodging, we got into the saddle and retraced our steps of the first day. All but the low meadow-land was wrapped in thick mist, which became denser and denser as we ascended; and when we reached the upper regions covered with the last night's snow, the compass was in constant requisition. Indeed, so utterly bewildering were the combined effects of fog and snow, that, on one of these references to our

magnetic friend, we found that we had managed to turn right round, and were marching in exactly the opposite direction to that we had intended. Towards noon we passed the col, and soon after the mist changed into actual rain. On leaving the snow we found the moor-land more swampy than ever; and Watkins narrowly escaped being bogged, pony and all. The rain had the one advantage of rendering the mosquitoes somewhat less vigorous in their attacks as we neared their habitations. Still there were more than we cared to meet of these interesting creatures, who beset us with a hideous buzzing, which, as it was only interrupted when their noses were deep in our skin, might possibly have been a translation of the celebrated speech of the simpering fellow with weak legs,—“Oh, you know, deuce take it! we can't forego blood, you know,—we must have blood, you know.” Gladly did we shake off our tormentors as we left the low woods and trotted along the half mile of open road into Talvik. We entered the village at 8.30 P.M., extremely moist, tired, and hungry, but by no means dispirited; and fully satisfied that we had done a wise thing in paying a visit to the Jökuls glacier.

CHAPTER XIII.

PHENOMENA OBSERVED ON PEAKS, PASSES, AND GLACIERS.



1. AMOUNT OF OZONE AT DIFFERENT ALTITUDES.
2. THE "DIRT-BANDS" OF THE LOWER GRINDELWALD GLACIER.

1. AMOUNT OF OZONE AT DIFFERENT ALTITUDES.

BY F. F. TUCKETT, F.R.G.S.

VERY general attention having of late years been directed to the subject of ozone, especially in connection with its bearings on the sanitary condition of the atmosphere, I venture to hope that the following contribution to the study of its diffusion at different altitudes may not be wholly devoid of interest or value.

This is not the place to enter into a discussion of the true nature of ozone, nor am I qualified to express an opinion as to whether the idea of Professor Faraday, that it is merely oxygen in an allotropic state, or that of its discoverer, Professor Schönbein, who would view it as a binoxide of hydrogen, is the more correct.

I have been in the habit of using the form of ozonometer prepared by Dr. Moffatt of Hawarden, and which goes by his name, believing it to possess advantages over that of Professor Schönbein in increased sensitiveness, and in the non-necessity of immersion in water, which permits of the preservation of the slips for years. For the information of those who may be disposed to take observations whilst travelling, I may mention that I have arranged a most portable form of case, which, after an examination of my specimens, has met with Dr. Moffatt's approval. To the edge of a tin or zinc disk, six inches in diameter, is attached some india-rubber cloth, which hangs down in a cylindrical form to a length of eight or ten inches, and is

entirely open at the bottom. A ring on the top of the disk serves to hang the apparatus outside a bed-room window, to a projecting rock, or to the blade of an ice-axe set up in the snow. To another ring on the under surface of the disk, a short piece of flexible brass wire is attached, on which one of the prepared slips of paper is suspended. The lower end of the slip should be about one inch above the bottom of the cylindrical case, so as to be protected from wet and the influence of light; when not in use, the whole packs flat into a space very little exceeding that occupied by a pair of socks or a map, and is therefore quite compatible with the exigencies of a knapsack. The prepared slips, with scale of tints, and a paper of instructions, may be procured of Messrs. Negretti and Zambra, Hatton Garden, London. If Schönbein's form of ozonometer is preferred, the case described is equally adapted to it, and Mr. L. P. Casella of Hatton Garden will furnish the needful materials. It is seldom possible in the course of a rapid journey, or when actively engaged in mountaineering, to arrange that each slip shall be exposed for exactly twelve hours, but comparative results of almost equal value may be obtained by simply noting, as I have done in the tables which follow, the number of hours' exposure, and then calculating the proportion for twelve hours. It is very desirable to record the hygrometrical condition of the atmosphere at intervals during the period of exposure, and also to observe the direction of the wind, the general character of the weather, and height of the post of observation. It will be seen that, in my own case, this has been done with some care for 1861, but only in a few instances for the observations of 1860, when I was less alive to the importance of these subsidiary data.

In this country it has, I believe, in most cases been found that ozone exists in larger quantities, or, at any rate,

is more energetic in its action, as the height of the station increases. For confirmation of this law as regards the Continent, I may cite the observations of the MM. Schlagintweit.* The mean of six observations taken at St. Anton, near Partenkirch, in the Bavarian Tyrol, at an altitude of 2461 feet, is 2·7 of Schönbein's scale, whilst the simultaneous ones made at a spot called the Huthaus, 4928 feet in height, give 4·4 of ozone.

My own experiments tend to a similar result, as an inspection of the table will, I think, demonstrate. There is, however, another element besides altitude which I conceive to have a very important bearing on the amount of ozone, and that is the degree of humidity. In damp or rainy weather, and especially during fogs, I have remarked that a large amount of ozone is indicated by the test papers, even at a low level, whilst, on the other hand, in fine bright weather, little or none can be detected at great altitudes. A comparison of observations, Nos. 65, 66, 67, 68, 69, with 70, shows this very strikingly. It has occurred to me that this result may possibly be explained on the supposition that the watery particles precipitated from a higher region may bring down, in a sort of mechanical suspension, large volumes of ozone, as in the case of carbonic acid; but I only throw this out as a hint to future investigators, and with very great diffidence. It is possible that this fact has already attracted notice, and been satisfactorily accounted for; but, not having access to the literature of the subject, I trust I may be pardoned if my conjectures should prove to be merely an attempt "twice to slay the slain."† The same exceptional absence or

* "Neue Untersuchungen über die physikalische Geographie und die Geologie der Alpen," p. 592.

† My friend, Mr. W. Mathews, has suggested to me that the greater intensity of the discoloration of the test papers in wet or foggy weather may

diminution of ozone at *great* altitudes, shown in the case of observation 70, has been observed by my friend, Dr. Kolb of Paris, who has paid much attention to the subject, and has kindly furnished me with some of the results gleaned in the course of his Swiss travels. All of them confirm the *general* tendency to an increase in quantity with increase in height, except in the last instance, which resembles my result on the Aiguille du Goûté, inasmuch as the amount of ozone recorded on the summit of Monte Rosa was only 2, whilst the simultaneous observation at the Riffel inn gave 4·6, and that at Zermatt 3·2.

Grouping together those observations of my own in the years 1860 and 1861, for which I have also hygrometrical data, in zones of altitude, I find the following general results:—

1860.

From 740 to 2000 feet	Ozone 1·5	Relative Humidity 67·5
„ 2000 „ 4000 „	„ 3·4	„ 85
„ 4000 „ 9000 „	„ 7·3	„ 86

1861.

From 1500 to 2000 feet	Ozone 1·7	Relative Humidity 58
„ 2000 „ 4000 „	„ 4·0	„ 74
„ 4000 „ 6000 „	„ 3·7	„ 70

If we take the entire series of 1860, irrespective of observations on the dew point and relative humidity, we get —

1860.

From 740 to 2000 feet	Ozone 3·3
„ 2000 „ 4000 „	„ 3·6
„ 4000 „ 9000 „	„ 5·8

The two series for 1860 show the existence of a general

be due, not so much to the larger quantity of ozone, as to the increased sensitiveness of the paper when in a damp state. The question is an important one, and I hope before long to be able to put it to the proof.

tendency to an increase of ozone with a simultaneous one of altitude and humidity; but the extent to which this latter agent contributes to the result is, I think, equally clearly indicated by the last line of the series of 1861, where a decrease in humidity is coupled with a diminished amount of ozone, even under the favourable condition of an increase in altitude.

I will conclude these remarks with the following extract from a letter recently received from Dr. Kolb.

“ Before I became acquainted with your ozone observations, I had a perfect conviction that the quantity increases *constantly* with the height. All my own had confirmed me in this opinion, and M. H. Schlagintweit, with whom I spent a fortnight three years ago amongst the peaks and glaciers of the Bernina, informed me that he too had found this law confirmed by numerous experiments up to a height of 19,000 feet on the Ibi Gámin, in the Himalayas. The result of my observation on Monte Rosa was, however, in contradiction to all that preceded it; and, supposing it to be defective, I was much vexed at having failed in one of the principal objects of my expedition. Since, however, I now find from you that you obtained little or no trace of ozone on the test paper exposed for twelve hours outside the cabane of the Aiguille du Gouté, I see clearly that my Monte Rosa observation was a good and valuable one, and that it tends to confirm your opinion of the dependence of the quantity of ozone upon humidity *as well as* altitude. It may be that, even under *similar* atmospheric conditions, the quantity of ozone increases steadily with the height up to an altitude of 10,000 or 11,000 feet, and then decreases again. This has lately been proved to be the case as regards carbonic acid gas by Professor Falkland, who, on analysing some air collected at the summit of Mont Blanc, found less carbonic acid gas

in it than in the same quantity taken at the Grands Mulets. Further inquiries are, I think, necessary to prove to demonstration that the quantity of ozone in the air really depends on humidity at all heights, or that above a certain point (10,000—11,000 feet) the conditions are reversed, and the amount, as in the case of carbonic acid, diminishes."

OBSERVATIONS WITH MOFFATT'S OZONOMETER, 1860-61.

Place.	Height.	Day.	Hour of Exposure.	Duration of Exposure.	Scale.	Scale for 12 hours.	Dew point.	Relative Humidity.	Weather.	Wind.	
		1860 July		Hrs							
1. Zurich . .	1382	3	4.30 p.m.	13 $\frac{1}{2}$	1	1	61°	85	Fine		
2. Splugen . .	4820	5	7.15 p.m.	9	3	4			"		
3. Bellaggio . .	740	6	6 p.m.	16	1	1			"		
4. "	"	7	10 a.m.	11 $\frac{1}{4}$	2	2	56°	50	"		
5. "	"	"	9.15 p.m.	6 $\frac{3}{4}$	2	4			"		
6. Milan . .	394	8	10.45 p.m.	8 $\frac{1}{4}$	3	4			"		
7. "	"	9	7 a.m.	12 $\frac{3}{4}$	3	3			Wet		
8. "	"	"	8 p.m.	10 $\frac{1}{2}$	4	5			"		
9. Lugano . .	1015	10	6.45 p.m.	12	6	6			Fine		
10. Domod'Ossola	942	11	12 night.	6 $\frac{1}{4}$	1	2			"		
11. Visp . .	2182	12	8.48 p.m.	14 $\frac{1}{4}$	5	4			Wet		
12. St. Niklaus .	3840	13	7.30 p.m.	12	2	2			Fine		
13. Zermatt, Riffel	8485	14	7 p.m.	13	6	6			"		
14. " " . .	"	15	8.30 a.m.	11 $\frac{1}{2}$	1	1			"		
15. " " . .	"	"	8 p.m.	24	7	3.5			"		
16. " " . .	"	16	8 p.m.	14	8	7			"		
17. Evolena . .	4540	18	9.30 p.m.	8 $\frac{3}{4}$	5	7			Wet		
18. Zinal . .	4936	19	9 p.m.	12 $\frac{1}{2}$	9	9	40°	79	"		
19. Zermatt . .	5315	21	6 p.m.	16	4	3			Dull		
20. St. Niklaus .	3840	22	11 p.m.	8	4	6			Wet		
21. Viesch . .	3830	23	7 p.m.	8 $\frac{1}{2}$	2	3			Dull		
22. Eggrischhorn, Hotel.	7150	24	7.15 a.m.	12 $\frac{1}{4}$	6	6	42°	86	Foggy		
23. " " . .	"	"	7.30 p.m.	12 $\frac{3}{4}$	10	10	40°	96	Foggy & snow		
24. " " . .	"	25	8.15 a.m.	13 $\frac{1}{4}$	5	5	37°	87	"		
25. " " . .	"	"	9.30 p.m.	11 $\frac{1}{2}$	6	6	35°	86	Foggy		
26. " " . .	"	26	9 a.m.	12	6	6	34°	71	Wet		Strong smell
27. " " . .	"	"	9 p.m.	26 $\frac{1}{2}$	10	5			Snow		

Place.	Height.	Day.	Hour of Exposure.	Duration of Exposure.	Scale.	Scale for 12 hours.	Dew Point.	Relative Humidity.	Weather.	Wind.
28. Faulberg Cave	9150	1860 July 26	10 p.m.	Hrs. 17	8	6			Snow & Fog	
29. Eggischhorn, Hotel.	7150	27	11.30 p.m.	8	6	9	38°	94	Fog	
30. Sion	1720	29	1.15 a.m.	12	5	5			Dull	
31. Martigny	1571	29	6.30 p.m.	11	3	3			Wet	
32. Chamouni	3458	31	7 p.m.	14	3	3			Fine	
33. "	"	Aug. 2	11.30 p.m.	13 $\frac{3}{4}$	5	5			Fog	
34. St. Gervais, Hotel Montjoli.	2664	3	7.15 p.m.	12 $\frac{1}{4}$	4	4	48°	86	Wet	
35. " "	"	4	7.40 a.m.	12	2	2	52°	89	"	
36. " "	"	"	7.40 p.m.	12	3	3	51°	84	"	
37. Chamouni	3458	6	7.45 p.m.	10 $\frac{3}{4}$	4	5	48°	81	Fine	
38. "	"	6	6.30 a.m.	12	3	3	45°	86	Wet	
39. "	"	"	6.30 p.m.	14 $\frac{3}{4}$	4	3			"	
40. "	"	7	9.15 a.m.	12	4	4			"	
41. Villeneuve	1280	8	5.45 p.m.	13 $\frac{3}{4}$	4	4			Fine	
42. Geneva	1290	9	9 p.m.	11 $\frac{1}{4}$	5	5			Wet	
43. Paris	1007	11	11.45 a.m.	11 $\frac{1}{4}$	1	1			"	
44. Grindelwald	3478	1861 June 8	11.30 p.m.	12 $\frac{1}{2}$	3	3	49°	55	Fine	S.W.
45. Kandersteg	3776	10	11.30 p.m.	5 $\frac{1}{2}$	2	4	38°	92	Wet	N.
46. Visp	2182	11	8 p.m.	10 $\frac{1}{4}$	3	3	45°	70	Fine	N.
47. Zermatt	5315	13	6.15 p.m.	12 $\frac{1}{4}$	2	2	44°	80	"	N.
48. Gressonay	4495	16	9.30 p.m.	13	3	3	50°	81	"	N.
49. Ponte Grande	1798	18	6 p.m.	10 $\frac{1}{2}$	1	1	48°	75	"	N.
50. Macugnaga	4305	19	2 p.m.	10 $\frac{1}{2}$	4	4.5	51°	81	Fog	N.
51. Zermatt	5315	20	6.30 p.m.	12	2	2	42°	53	Fine	N.
52. " "	"	23	9.30 a.m.	12 $\frac{3}{4}$	3	3	46°	51	Dull	N.
53. " "	"	24	5.30 a.m.	18	3	2	41°	64	Fine	N.
54. Aosta	1969	27	12 noon.	10 $\frac{1}{4}$	1	1	49°	50	"	S.
55. " "	"	"	10.30 p.m.	8 $\frac{1}{2}$	3	4	52°	72	"	N.
56. Martigny	1571	29	2 p.m.	19	6	4	47°	55	Wet	S.
57. St. Pierre	5335	30	8 p.m.	7 $\frac{3}{4}$	5	8	37°	85	Dull & Fog	N.

TABLE OF OBSERVATIONS.

453

Place.	Height.	Day.	Hour of Exposure.	Duration of Exposure.	Scale.	Scale for 12 hours.	Dew point.	Relative Humidity.	Weather.	Wind.
		1861. July.								
58. Aosta . . .	1,969	1	12.45 p.m.	9 $\frac{3}{4}$	0	0	46°	44	Fine.	N.
59. " . . .	"	"	10.30 p.m.	5 $\frac{1}{2}$	0	0	43°	54	"	N.
60. Cormayeur . .	4,072	6	4 p.m.	16	8	6	46°	70	Wet.	W.
61. " . . .	4,072	7	8 a.m.	11	3	3	44°	61	Dull	W.
62. Chamouni . .	3,458	8	11 p.m.	12	5	5	48°	75	Wet	W.
63. " . . .	"	9	11 a.m.	12	3	3	46°	74	"	W.
64. " . . .	"	"	11 p.m.	8	3	4.5	46°	86	"	W.
65. St. Gervais, Hotel Montjoli.	2,664	13	4 p.m.	7	4	7	45°	58	"	W.
66. " " . . .	"	"	11 p.m.	10	3	4	51°	76	"	W.
67. " " . . .	"	14	9 a.m.	26	4	2	53°	67	"	S.W.
68. " " . . .	"	15	11.30 a.m.	11 $\frac{1}{2}$	4	4	53°	77	"	S.
69. " " . . .	"	"	11 p.m.	12 $\frac{1}{4}$	5	5	51°	81	"	W.
70. Aiguille du Goûté	12,530	17	5 p.m.	11	1	1			Fine	W.

OBSERVATIONS WITH SCHONBEIN'S OZONOMETER, COMMUNICATED BY DR. KOLB.

Da y.	Hour of Exposure.	Length of Exposure.	Place.	Height.	Scale.	Place.	Height.	Scale.
1857. Aug. 30	11 a. m.	2	Macugnaga	4303	4.2	Weiss Thor	11,851	6
Aug. 16	10 a. m.	2	Lauterbrunnen	2602	3.1	Mürren	5,348	4
1859. Aug. 23	1 p. m.	2	Viesch	3830	3	Æggrischhorn, Hotel.	7,150	4.2
Sept. 10	1 p. m.	3	Pontresina	5932	2.6	Piz Languard	10,715	4
1861. Aug. 8	11.30 a. m.	1	Saas	5125	3.6	Alphubel Joch	12,575	6
Aug. 10	11.45 a. m.	3	Zermatt	5315	3.2	Riffel	8,427	4.6
						Monte Rosa, Summit,	15,217	2

2. NOTES ON THE "DIRT-BANDS" OF THE LOWER GRINDELWALD GLACIER.

By F. F. TUCKETT, F.R.G.S.

A CORRESPONDENCE with Professor Forbes in the spring of 1859, in which he urged me to give a little more attention to scientific questions, led to my establishing myself for a couple of days in June of that year at the châteaux of Stiereck, close to the "*eismeer*" of the lower Grindelwald glacier. My principal object was an examination of its laminated or "ribbon" structure, and the measurement of its dirt-bands. To the former I shall not here allude; but a few extracts on the latter subject from a letter addressed to Professor Forbes on my return in September, may perhaps interest some readers.

I should premise that Professor Forbes and the late Mr. Milward had already thrown much light on the whole subject*, whilst Professor Tyndall had given an explanation of the mode of formation of dirt-bands† almost identical with that which follows. I had not, however, access to this latter source of information till a later period, nor, of course, to the further details published in 1860 in the "Glaciers of the Alps," page 372 *et seq.*

* Forbes's "Occasional Papers on the Theory of Glaciers," pp. 21—25, 39—41, 213—217, 247, 262—265.

† In a paper read before the Royal Society, February 24th, 1859, "On the veined structure of Glaciers; with observations upon white ice-seams, air-bubbles, and dirt-bands, and remarks upon Glacier theories."

After some remarks on the general condition of the glacier, and the developement of the veined or "ribbon" structure, my letter proceeds:—"On rousing from our hay in the Stiereck châlet at 2 A.M., we found the weather so stormy that all idea of crossing the Strahleck was out of the question. We therefore turned in for a further doze; and as towards noon the day improved, Lauener and I started to explore, whilst Victor descended to Grindelwald for a further supply of provisions. On the previous day I had counted nine dirt-bands, crossing that portion of the glacier which descends from the Viescherhörner. The spaces between these were occupied by considerable swells or hillocks of ice*, whilst, in immediate contact with each band of dirt, and invariably on its northern or lower side, a strip or patch of unmelted snow was distinguishable, so that a section of the glacier in the direction of its length would have presented the annexed appearance.



"The limits of each band and 'wrinkle' were so clearly defined, by the existence of an incipient crevasse in the interspace (perhaps in this stage of developement as much the effect of water as of strain) that, provided with a good 100 foot tape, I at once proceeded to measure the entire series. My chief difficulty was to fix upon a well-defined starting-point, as immediately at the base of the Viescherhörner the ice was in so disjointed a state, and so cut up by valleys and watercourses in all directions, that any accurate mea-

* "Wrinkles." Forbes' "Occasional Papers on Glaciers." Fifth Letter, pp. 40, 41. A. and C. Black, 1859.

surement was impossible, and I considered that little value would attach to what, at best, could be but a loose estimate. I therefore descended a distance of one or two hundred yards till I came to a monticule or hummock, well-defined at its upper and lower extremities, and the first of a series of nine or ten, which extended nearly as far as a point opposite the angle of rock bounding the Stiereck pasturages on the N.

“Sending Lauener forward with the end of the tape, I descended along the crests of the series, measuring the distance between the crevasses. These, as already described, coincided with the apices of the dirt-bands, which covered a breadth of twenty or thirty feet upon the lower terminal slope of each monticule. At first the crevasses were of slight depth, and either formed the bed of a stream or were filled with standing water, which, however, cut into the ice to a greater depth the further I went, and aided to produce what became at length developed into well-defined fissures of one to three feet in width and several yards in depth. Next to the stream or crevasse on the ascending slope of the succeeding monticule, a bed of snow from ten to forty feet in breadth invariably occurred. At first it struck me as rather strange that it should have completely melted on the N. of each hillock, and yet remain on the southern side with its warmer exposure. This result might, however, be due to the direction of the recent snow-storms, which, coming from the S., would naturally accumulate more considerable masses in this position. I have little doubt that in and beneath these strips of snow much dirt and débris existed, which would finally be deposited on the ice, and thus increase the width of the band of discolouration. It appeared, then, clear from these facts that the bands are produced in something like the following manner : —

"Admitting the existence of the undulations, 'wrinkles' or monticules (for they are real hills, rising twenty or thirty feet above the general level, and sometimes terminating so steeply at their lower extremities as to require caution in descending them), but without for the present going into the question of their origin, let us consider the glacier as it would appear during spring before the melting of the snows. These snows, covering the entire surface, would gradually become discoloured by the dirt which storms of wind sometimes deposit over vast areas in an astonishingly short space of time, whilst masses of *débris* of larger dimensions would be met with, scattered up and down over the surface, or concealed in the interior of the snowy covering. The finer particles would be carried by the wind into the hollows, rather than on to the more exposed portions of the surface, and hence there would gradually be accumulated in the interspaces between the undulations a considerable amount of foreign matter, which, as the snow melted, would of course be deposited upon the ice. These dirt accumulations would further be increased by the smaller but still considerable amount of *débris* resting upon the sides and summits of the hillocks, which the streams produced by the melting of the snow, and the surface ablation of the ice, would speedily convey into the hollows. The process seems to me obvious, and was, in fact, going on beneath my eyes.

"Beginning at the upper boundary of the first well-defined undulation, I obtained the following results for it and the succeeding ones, measuring downwards:—

No.		Feet.
1	. . . . .	363
2	. . . . .	400
3	. . . . .	361
4	. . . . .	420
5	. . . . .	402

•

TABLE OF DISTANCES.

459

No.								Fect.
6	.	.	.	.	.	.	.	350
7	.	.	.	.	.	.	.	400
8	.	.	.	.	.	.	.	400
9	.	.	.	.	.	.	.	378
10	.	.	.	.	.	.	.	367
11	.	.	.	.	.	.	.	300

Of these, Nos. 10 and 11 were so imperfectly separated, that I found it difficult to decide on their respective lengths, but finally fixed on a crevasse as the boundary line. Below the bottom of No. 11 the glacier became much crevassed, and the next monticule, if another indeed existed, was mingled with, and lost in the final ice-fall."

CHAPTER XIV.

HYPSOMETRICAL SUGGESTIONS.



1. HYPSOMETRY AND THE ANEROID.
2. CONTRIBUTIONS TO ALPINE HYPSOMETRY.

1. HYPSONOMETRY AND THE ANEROID.

BY THE REV. G. C. HODGKINSON, M.A.

OF the many travellers who year by year bend their steps to the Alps, in search of a new pleasure, or to balance the year's account of overtaxed energies by the most invigorating of recreation, probably very few think of engaging in observations similar to those which are the subject of this paper. Some there will doubtless be to whose tastes and habits of mind such an occupation would be uncongenial; still, putting these out of the question, it will be true that of the remainder only a small proportion has hitherto taken an active part in the collection of those physical facts which meet them at every turn in their travels. If that proportion can be materially increased, something will have been gained, both for the stores of Alpine experience and for the observers themselves. This, I am aware, is debateable ground; and it may be urged, on the one hand, that a certain character of mind, and much previous practice on the part of the observer, is necessary to ensure value for such observations, while on the other, some may be disposed to question whether the enjoyments and benefits of Alpine travel admit of being increased by such pursuits. What, it may be asked, can add to the pleasure of revelling at ease in that glorious scenery? What refreshment so great as thoroughly to unbend the weary mind? And yet those who have made the trial among her rocks, her flowers, her snows, have found

that nature ever reveals herself in her fairest hues to those who consult her oracles. The powers of observation are strengthened; beauties are gradually unfolded which once passed unnoticed, and those before perceived imperfectly are more thoroughly seen and enjoyed.

Some of the observations here proposed require, with the contemplated appliances, no long previous apprenticeship; besides the interest which they cannot fail to possess for those who make them, they will help to delineate by degrees more and more accurately the features of the higher Alpine tracts which have lately been the scenes of so much enterprise and activity, and pleasant reminiscences of which find an appropriate place in this volume. The truth is, that exploration advances at a higher rate than methodical observation; and if something remains to be done in breaking new ground, much more remains to be done in traversing with instruments, districts lately opened out; which, even if every traveller who has penetrated them had been an ardent observer, would still furnish abundant work for the future. There is a remarkable dearth of observations among the higher regions. Take, for example, the well-known route between the Grands Mulets and the summit of Mont Blanc: we have many points well-known by distinctive marks and familiar names, the Montées, the Petit Plateau, the Grand Plateau, the Corridor, the Petits Mulets, the Mûr, the Calotte,—but how many observations have we, for example, for determining the height from the bottom to the top of the Mûr, and the same for the Calotte? Instances might easily be multiplied. Again, of men of science, not every one is equal to reaching the less accessible parts of the higher mountains. And even in the case of the hardy mountaineer, when these are attained, unless he carefully watches and trains himself, his powers of observation will probably cease to be on the alert.

This is especially the case on commanding summits; we allow ourselves to repose almost in bewilderment at the amazing magnificence around us. But, nevertheless, a strong resolution knows how to assert its sway, and will overcome the natural disinclination for the work of observation. As there is worthy occupation on the mountain side for the artist, the botanist, the geologist, so is there also for the meteorologist that which will combine harmoniously with his enjoyment of the scene, and even enhance it. The landscapes and the flowers have their votaries not a few; and if this brief notice should happily win some gleaners for the field of meteorology, and make their first steps at all easier, it perhaps will not be without its use, certainly not without its gratification. Some hints of the kind, in short compass, I should have been glad to meet with a few years ago, and therefore hope that these may not now be unacceptable to others circumstanced as I was then.

In order that observations may be fairly within our power in places not easily accessible, the instruments employed must be such as may be expected to endure the perils and rough work of difficult climbing. If many observations during the day's work are desirable, then the further condition must be fulfilled that the act of observing shall be such as to involve little delay *en route*. If the observers are to be otherwise than few, and their records accurate, the instruments adopted must not be of extreme delicacy or complication, or soon liable to derangement, but such as with a little practice and ordinary care may be used to good purpose. These are conditions which we cannot expect all meteorological instruments to fulfil. We must make our selection accordingly: for in proportion as these conditions are fulfilled, we shall enlist new observers, and multiply trustworthy observations of

a class in which numerous results with tolerable accuracy are to be preferred to a few with extreme refinement.

Until recently the instruments for measuring heights without having recourse to levelling or trigonometrical survey were the mercurial barometer, the sympiesometer, and the open scale thermometer of short range below 212° Fahr., with cauldron, for ascertaining the boiling point to 180° Fahr. Of these the two former require to be carefully guarded from sudden and violent jar, the probable consequence of which is fracture in the case of the barometer, and fatal derangement in that of the sympiesometer.

To observe the barometer in a room under favourable circumstances with perfect accuracy requires some little practice. Supposing the art attained, there arises the more formidable difficulty *en marche* that, to get an observation which can be relied on, a considerable halt is necessary, in order that the mercury may have time to settle. The ordinary boiling point apparatus is a troublesome instrument, especially at great heights. I found one of the old construction to require, even in a room, full ten minutes to complete an observation. The instrument as modified by Mr. Galton I have never used, but it is certainly much lighter and more portable, and is said also to be more expeditious; but it does not seem likely that a boiling point apparatus can ever be an instrument well adapted to the snow-fields.

With any of the above three instruments, great frequency of observation is out of the question. Let us see, then, how far the aneroid barometer is likely to serve our purpose for the kind of observations I am advocating.

The aneroid or non-fluid barometer consists of a cylindrical box of about three inches in diameter and a quarter of an inch in depth, exhausted of air and hermetically

sealed. The top of the box is corrugated; and its centre is attached to the arm of a lever, whose axis rests on two supports, each rising about an inch from the plate to which the vacuum-box is firmly secured. The other arm of the lever is counterpoised by a spiral spring, also fixed to the bottom plate: and the extremity of this arm is connected with simple mechanism for effecting the circular motion of an upright axis, which, being steadied by a hair spring, carries the pointer. If the pressure of the air on the vacuum-box lid be considered the power, and the resistance of the spiral spring the weight, the lever is of the third order. The whole is inserted in an outside case, the top of which is formed by the dial plate and glass, removable at pleasure; so that the interior of the instrument may be readily examined.

The Aneroid* fulfils the two essential conditions of being both hardy and handy. It will bear even rough usage without breaking down. In 1859, having previously been urged with eminent London opticians for a more serviceable instrument, I carried an aneroid of ordinary construction, purchased of Newman in 1849, through a five weeks' walk in the Alps. It had to put up with the worst of stowage in a bundle, packed with a sheet of macintosh which had been substituted for a knapsack, that it might be of use in camping out. Nevertheless the aneroid only once got deranged; that occurred on the top of the diligence, near Lungern, owing to the kinking of the chain, as we were passing over a rough piece of road. During the day's walking I found it had righted itself, and though carried up and down without particular care, day after day, over great heights, it never went wrong again.

* "Aneroid" = unfluid, the derivation being from a privative, and *νηρός* (for *νηρός*, cf. *νῆμα*) fluid.

On my return, after only a small rectification of the standard, it gave as good results as ever near the sea-level. But the aneroid to which I am referring ranged only from about 31 inches to a little below 23 inches; and on attaining a height somewhat above 7000 feet, the spring was so far relaxed that the extremity of the lever came in contact with the top of the box. In its construction, in all probability, only ordinary barometrical indications about the sea-level were ever contemplated. Its performances therefore augured all the better for what might be expected from an instrument made expressly, with extra care and labour, for hypsometrical purposes.

The inventor's patent having expired in 1859, I hoped that English skill and enterprise might be enlisted in producing an aneroid of superior workmanship, with an extended range.

In the spring of 1860 the following specification was sent to the leading instrument makers in London, with an offer of a premium of 10*l.*, besides the price, for the best instrument which should be sent in to the Alpine Club fairly fulfilling the conditions: —

“The range of the instrument is to extend from 31 in. to 16 in. It is believed that this may be effected by a single vacuum-box and set of works; and the following construction is suggested with a view to lightness and portability.

“While the pressure varies from 31 in. to 16 in., the index is to be carried twice round, extending in both directions from the centre, and consisting of two arms, one $1\frac{3}{4}$ in. and the other $1\frac{1}{2}$ in. long, sweeping circles respectively $3\frac{1}{2}$ in. and 3 in. in diameter; the graduation of the inner circle extending from 31 to 24, and that of the outer from 24 to 16; the mark 24 on the larger and smaller circles being exactly 180° apart, so that the indications begun on the

inner circle by the shorter arm are continued by the longer arm on the outer circle.

“The index should move in a plane as near to the graduated plate as may be consistent with security against contact. Compensation under changes of temperature should be aimed at by a judicious distribution of different metals among the levers. The divisions are to be carried to the fiftieth of an inch. Lightness to the utmost extent consistent with strength and durability is an important requisite. It is thought that the instrument need not weigh more than 16 ounces. A leathern case should accompany it fitted with a moveable front, which will admit of the instrument being read without being removed from the case.

“In order to determine the respective merits of the instruments they will be carefully tested in the following particulars.

“1. Correctness of graduation throughout the scale.

“2. Compensation for temperature.

“3. Resumption of readings corresponding to given pressures after repeated applications of the air-pump.

“4. Behaviour in all respects after being conveyed in a knapsack a testing distance (*a*) on foot, (*b*) on horseback, (*c*) on the top of a carriage over a London pavement.”

The specification had first been submitted to an eminent mechanist, especially on the points whether sufficient effective range could be got without requiring too much play in the lid of the vacuum-box; and whether any difficulty need arise from the chain passing twice round the axis. His opinion was entirely favourable on both these points.

The makers to whom the specification was sent were informed that it might be considered in some respects only suggestive, that the aneroid best adapted for the work

would be preferred, whatever the details of its construction. The effective range alone was imperative.

The circular to the instrument-makers brought no aneroid into the field, and disappointment alone was the result of this, as of the previous endeavour. A range to give good results up to 7000 or 8000 feet was the best offer. I found another member of the Alpine Club pursuing the same object; he had engaged the efforts of a London optician; and they had arrived at the conclusion that in order to secure a range from 31 in. to 16 in. at least two, and most probably three separate aneroids would be required, dividing the range among them. The burthen of the optician's answer to enquiries made in 1860 and 1861 was,—difficulty great: progress slow: success not despaired of: two instruments at least would be necessary. The difficulty was said to be with the vacuum-box, as the movement of the top must be confined within the narrowest limits, otherwise the instrument failed to recover its standard after being subjected to the rarer atmosphere. Hence the necessity for at least two instruments, the vacuum-box lid of each having only half the play which would be required in order that the range might be concentrated in a single instrument.

Upon repeated representations of this difficulty, the following plan occurred to me for overcoming it, without resorting to a second instrument.

Let the vacuum-box and its lever be fixed on one stage, and the spiral spring with its system of levers on another; let the centre of the vacuum-box lid be restricted to a very small extent of motion, by placing two rests, the one above, and the other below the lever on which it acts. The rests should be slightly elastic, so as to avoid jar, but should allow the lever only just sufficient play to work clear of them. The two stages, that of the vacuum-box and

that of the spring, should be arranged so as to approximate by a slow motion screw, which would have to be adjusted for each observation, until the lever should stand clear of the rests. Extent of range might obviously also be gained without increasing the play of the centre of the vacuum-box lid by giving greater rigidity to the spiral spring, so that for a given difference of atmospheric pressure the extremity of the spring would traverse a less space. This would tend to reduce the openness of the scale, which however might be preserved, by either giving the mechanism between the spring and the pointer a higher multiplying power, or by increasing the diameter of the graduated circle.

About Christmas 1860 Professor Miller, whom I had consulted on some of the foregoing difficulties, advised me when next in Paris to call on M.M. Lerebours and Secretan (M. Secretan alone now represents the firm), 13 Place du Pont Neuf. Disappointed in my hopes of being able to accompany my friend Mr. Hudson to Switzerland last summer, I urged him, instead of being content with an improved instrument of only eight or nine inches range, lately submitted by a London optician, to try what he could meet with on the native soil of the aneroid—in Paris, where it had been from the first, and perhaps exclusively, manufactured. He did so, and obtained an instrument of M. Secretan which, so far as his experience of it went, gave him great satisfaction, and promised to be just the companion for a mountaineer exploring the higher ranges. He informs me, that “the needle on descending returns exactly to the point from which it originally started.” To encourage travellers in the High Alps to procure this instrument, the price of which in a case is 100 francs, and to make testing observations with it, is one of the objects of this paper.

Mr. Hudson's aneroid ranges from 800 mm. (31.5 in.) to 380 mm. (14.96 in.), and should be available up to about 18,000 feet above the sea-level. Its weight is 30 ounces, and the diameter of the graduated circle 3.8 in. M. Secretan informs me that M. Vidi, the inventor, has been able to furnish an effective range from 800 mm. (31.5 in.) to 300 mm. (11.8 in.), which will serve for an elevation of nearly 24,000 feet. In India or South America, or for balloon ascents, such an instrument would be a great boon; but for European mountains it would be preferable to have a smaller range—from about 780 mm. (30.71 in.) to 400 (15.75 in.); because, with the same diameter of the graduated circle, a more open scale is obtained. M. Secretan states that the compensation for temperature in the mechanism of the instrument is perfect, and that, consequently, no correction is required. He also assures me that it returns to its point of departure after being used at great heights. The possession of this essential qualification, and the compensation for temperature, require testing. The graduation is experimental, being marked off, centimetre by centimetre, according to the readings of a standard barometer placed side by side with it under the air-pump. If M. Secretan's confidence is justified, the convenience of this mode of graduation for the class of observations here more especially advocated, is obvious; but, should the aneroid be convicted of any material deviation from the standard on the traveller's return, the recorded observations will need to be corrected, and will even then be invested with a much lower degree of authority than if the standard is found to be preserved. In this case there will be a balance of advantage in marking only the two extreme points by comparison with the mercurial barometer under the air-pump, and in graduating equally between these, instead of taking each

centimetre experimentally, and dividing unequally. A register of the index error throughout the scale will have to be very carefully made for each instrument. The equal graduation would allow a vernier to be used for reading off, if found desirable.

I would by all means suggest that the aneroids should be graduated with English inches, as well as with millimetres—the latter as most convenient for immediate comparison with the recorded observations at Geneva and St. Bernard; the former for obtaining approximate results at the moment from the observations made during the walk. This might be conveniently effected by extending the pointer both ways from the centre, and making one of its arms a little longer than the other, so that the extremity of the one arm might traverse a circle graduated by millimetres, the other a second circle marked with inches to fiftieths.

Taking an observation of the aneroid gives hardly more trouble than ascertaining the hour by a watch, and entails upon the traveller *en marche* only a momentary halt, since the faithful pointer follows surely and instantly every step of ascent or descent. Neither will the observation of the temperature, except in rare cases, involve any more delay, if only a suitable thermometer be employed. While the barometer can be observed only sparingly during the day's walk, by reason of the time absolutely necessary to ensure a perfect settlement of the mercury, aneroid observations may be multiplied to almost any extent without inconvenience. But if observations were to be multiplied, it seemed desirable that the means for their computation should be simplified as much as possible by compounding for the smaller corrections. This consideration, and the interest which is attached to knowing on the instant the number of feet of ascent or

descent between successive observations, induced me two years ago to make the necessary calculations for this purpose, and have the results printed, with simple instructions, on a card *, which would be more durable than paper, and more readable in the wind. As the aneroids for sale in England have been dialled with a scale of inches generally divided to every fiftieth, and of course capable of being read with ease to the hundredth of an inch, the readings of the aneroid, and the corresponding height in feet, were tabulated to every tenth, with a column of difference for computing the number of feet due to the place of hundredths. The traveller, with this card in his hand, can ascertain at once the difference of altitude of any two points in his line of march. Not only to the meteorologist, but to the botanist, or geologist, intent upon the limits within which certain plants or rocks occur in certain localities, such information on the spot must be of much interest.

With such facilities for observing, afforded by the aneroid, there may perhaps be travellers who will not think it too much trouble to record the observations of their day's walk in some such form as that below. The other instruments to be employed besides the aneroid will be the dry bulb thermometer, necessary to be observed with the aneroid for the calculation of the height; the wet bulb thermometer, for ascertaining, by comparison with the dry, the relative humidity; the clinometer, and the azimuth compass.† Unless the traveller has experience of the wet

* Some of these are deposited at the Alpine Club, and are at the service of any members who have occasion for them.

† To these might perhaps be added ozone paper, and sensitive paper prepared with nitrate of silver, to be kept carefully, of course, from the possible intrusion of light until the moment of use. With due management this might probably answer well as an actinoscope. Observations with the actinometer on high summits would doubtless be interesting; but the instrument is not one suited for general use, and requires a continued

bulb thermometer, it is better altogether omitted on account of the precautions necessary for its effectual use, nor can it be observed to good purpose in a series of short halts.

1.	2.	3.	4.	5.	6.	7.	8.	9.
Duration of Halt.	Place of Observation.	Time.	Thermometer.		Aneroid.	Wind.	Sky.	Continuation of Route.
			Dry.	Wet.				
EXAMPLE.								
29th July, 1859.								
h. m.		a. m.						
.	Foot of steep Ascent to Bosse du Dromadaire	9.40	36°	.	17.64	NNW.	Clear	$\nearrow 28^{\circ} \times 25'$ S.E.
0 8	Rock	10.13	35°	.	17.12	.	.	$\searrow 24^{\circ} \times 18'$ S.E.

In column 9, which involves the use of the watch, clinometer, and compass, $\nearrow 28^{\circ} \times 25'$ denotes a rise of 28° on the average for 25 minutes: to denote a like descent the symbol $28^{\circ} \times 25' \searrow$ may be employed. S.E. denotes that the average progress during this time is south-east. Between successive observations of the aneroid, more than one entry might be made in this column if desired. The most important columns are 2, 3, 4, 6, 7, 9: the form may be varied according to judgment or fancy, and would not generally include all the particulars given here.

Even if the full table were adopted, there is no necessity for an entry being made in every column at each halt. A few minutes before setting out will suffice to rule a portion of the traveller's note-book for such entries as he may select. With regard to the gradients on the line of march,

attention which it could not receive under ordinary circumstances from the traveller in the Alps.

without measuring the angle by the clinometer, the untutored eye is apt to form the most erroneous estimates, generally much in excess of the truth.

It will be seen that routes may be laid down with considerable accuracy, by means of observations registered in the manner proposed. Succeeding travellers would thus be furnished with serviceable hints for their excursions, and they in their turn would contribute to still closer approximations. Several such registers of different routes through a district would furnish materials for laying down a trustworthy map on a good scale, in which guesses should no longer take the place of observed facts. By taking the mean of observations made with the aneroid at the same points at various times by various observers, and under every variety of favourable circumstance, the errors incident to single observations would be eliminated, and an extensive table of very approximate heights might thus in a few years be formed. It may be worth considering whether this end might not be promoted if the Alpine Club were to open a register for these observations.

A few remarks upon the formula for the computation of heights from records of barometric pressure and temperature, and on the precautions to be taken in selecting the readings of the aneroid, will form a suitable conclusion to this paper.

And first, what degree of correctness are we entitled to look for in the computed heights, when the corresponding observations have been made with all due precaution, under the most favourable circumstances? In the investigation of Laplace's formula it is assumed that the two stations, the difference of whose height is sought, are situated one above the other in a vertical line; and that the column of air between them has throughout a temperature equal to the half sum of the temperatures at the upper and

lower stations. But, in fact, the temperature decreases gradually as we ascend. The amount of this decrement for a given height varies to some extent with the latitude and other circumstances, for different parts of the earth's surface. Buff gives 2°C . ($3^{\circ}\cdot6\text{ Fahr.}$) as the average decrement for every thousand feet of ascent. Mr. Welsh, in his four balloon ascents in the south of England in 1852, found a remarkable interruption to the law of uniform progression, which had been supposed to prevail. After a steady fall of the temperature from the sea-level, up to a height varying from 2500 to 4000 feet, and once exceeding this, the decrease was arrested, and throughout a height of about 2000 feet the temperature remained nearly constant, or even increased by a small amount. The decrease was afterwards resumed, and continued with much steadiness, at a rate somewhat less than before the interruption.

The average decrement of temperature was :

For the entire ascent	$2^{\circ}\cdot6\text{ F.}$	per 1000 feet.
For the part below the interruption .	$3^{\circ}\cdot6\text{ F.}$	"
For the part above the interruption .	$3^{\circ}\cdot2\text{ F.}$	"

This want of continuity in the decrease of temperature as we ascend will cause the height of the column of air as computed by Laplace's formula to differ somewhat from the actual height : nor does the state of our information at present enable us to calculate the exact effect of the anomaly even in a balloon ascent. If the temperature decreased with perfect regularity upwards, we should not need the barometer to calculate heights—the thermometer alone would suffice ; and even under existing circumstances, by taking the mean temperature of two places at the most favourable time of day for a long period, an approximation to their relative height will result.

Again, even if equal decrements of temperature corre-

sponded to equal increments of height, this law is not exactly represented by the assumption in Laplace's formula. For the supposition that the temperature of the column of air is throughout equal to the half sum of the temperatures at its two extremities is not, as M. Plantamour seems to have regarded it (*Mesures Hypsométriques*, p. 11, l. 28), identical with an uniform decrease, but really represents the condition that equal decrements of temperature correspond to increments of height, which form the terms of a decreasing arithmetic series, whose common difference, however, is practically very small. (Herschel, *Meteorology*, Art. 32.) I am indebted to Mr. W. Mathews for pointing out to me, that if the problem be investigated on the supposition that the temperature decreases uniformly with the height, the results given by the formula so obtained are, *in all cases*, slightly in defect of those given by Laplace's. I have since seen a paper by M. Babinet, printed in the *Comptes Rendus*, September 30, 1861, in which, after arriving at the same formula as Mr. Mathews, he has failed to perceive the consequences of his result. He seems to have been misled by taking a particular example with a mean temperature below zero C., and instituting a comparison between his own formula with a coefficient of dilatation $\cdot 0036$, and Laplace's with a coefficient $\cdot 004$. In his example he supposes the barometric pressure at the upper station to be half that at the lower; the temperature at the lower to be 0° C., and at the upper -20° C.; and obtains for the height by his own formula 5331^m. He then proceeds: "La formule de Laplace donne 5315^m. La différence est de 16 mètres, ce qui est d'autant plus étonnant que Laplace avait altéré en plus les deux coefficients physiques, de sa formule pour se rapprocher de l'observation." But there is indeed no cause for astonishment, when it is observed that the term depending on the diffe-

rence of the mean temperature from zero C. is subtractive in the example owing to that difference being negative; and that this term is larger in Laplace's formula, owing to the increase of the coefficient of dilatation. Hence a larger quantity is subtracted in the case of Laplace's formula; and a smaller value is obtained for the resulting height. The second physical coefficient referred to by M. Babinet is the same in both cases; since the value which he adopts for the ratio of the density of mercury to the density of air, at 0.76^m pressure and 0° C. temperature, is 10510, and this, when multiplied by the pressure 0.76^m, and divided by the modulus (·4343 nearly), gives 18393^m, the number which he has used for the multiplier in Laplace's formula.

Tables for the more ready computation of heights have been calculated by various authors. They will be found to give results differing somewhat from each other, mainly owing to the adoption of different values for the ratio which the density of mercury bears to the density of dry air under 0.76^m pressure at 0° C. temperature. The value of this ratio, determined at 10,467 by Biot and Arago, has by the more recent experiments of Regnault been placed as high as 10,517; and various intermediate values have been assigned to it by others. Thus it is manifest that, independently of an additive correction for moisture, a difference amounting to about ·005 of the whole result will be produced according as we use the larger or the smaller value of the ratio. The limits within which the coefficient of dilatation may have its value assigned, on account of the increase of moisture in the air due to an increase of temperature, may possibly cause a second discrepancy of about equal amount, to which must be added the smaller one arising from the mode of dealing with the decrement of temperature due to the increase of height.

But furthermore, whatever be the case in the higher

regions of the atmosphere, we know that at the earth's surface there occur *local* disturbances of temperature, some of a constant, others of a fluctuating nature. The configuration of the ground, the presence of a glacier or of a lake, may be named as instances of the former, and of the latter, the solar influence. These causes may jointly or severally, and by operating at one or both stations, contribute to prevent the temperature of our imaginary column of air being represented with near approximation by the half sum of the temperatures at the upper and lower station.

When the two stations are at a considerable distance apart in a horizontal direction, another source of error is introduced. For, in applying the formula; we tacitly assume that the pressure and temperature at the higher station correspond to those at a point on the same level with it, but situated vertically over the lower station. The further the stations are apart, the more danger there is of this assumption being wide of truth. Where the horizontal distance is great, single observations, made under even the most favourable atmospheric conditions, cannot be depended on for giving the height accurately; but by taking the mean of a number, errors are eliminated, and a result is obtained very near the truth. The chance of error is further decreased by comparing the observations at the higher station with those taken at several lower ones on different sides of it.*

On the foregoing points, the "Mesures Hypsométriques dans les Alpes" of M. Plantamour, extracted from the fifteenth volume of the "Mémoires de la Société de Physique et d'Histoire naturelle de Genève", for a copy of

* The readings of the barometer at Geneva and St. Bernard may be obtained monthly in the Archives Scientifiques of the "Bibliothèque Universelle de Genève;" and those taken at Aosta, by M. Carrel, in the "Feuille d'Aosta."

which I am indebted to the kindness of Mr. Tuckett, is rich in valuable and conclusive testimony. The daily observations of the barometer at Geneva and St. Bernard afford an excellent opportunity of noticing the wide discrepancies of results calculated from only single observations, while the accurate knowledge of the difference of height of the two barometer-cisterns obtained by the spirit-level enables us to compare the mean of the results with the truth, and so to apply a severe test to the hypsometrical formula.

M. Plantamour gives the height of St. Bernard above Geneva, as ascertained by levelling, at 2070.3^m (6793 feet). The height computed by his own tables (the tables of Guyot, Delcros, and Oltmann give results considerably less), and from the mean of observations of pressure and temperature during eighteen years, is 2065.9^m (6778 feet). The difference, amounting to 4.4^m , he accounts for, after discussing other alternatives, on the ground of a local cooling at Geneva, arising from the vicinity of the lake. Hence too low a value is furnished for the mean temperature in the formula; and the calculated height is diminished accordingly.

From much that is interesting in M. Plantamour's memoir I select for notice, before concluding, a single other point. This relates to the time of day which is most favourable for hypsometrical observations. From readings of the barometer taken at various hours, from 6 A.M. to 10 P.M., during the months of June, July, August, and September, he shows in the clearest manner that the calculated agrees with the actual height most nearly when the observations are made about two hours after sunrise or shortly after sunset, and that the readings which give results furthest from the truth are those taken at noon or shortly after. It may be remarked that Francœur, in his treatise on hydrostatics, selected as examples for the formula those

observations of De Saussure which had been made about noon, *as being attended with more certainty*. But the truth is, that during the heat of the day the temperature at a point a little above the earth may, and generally does, differ materially from the temperature near the ground. The warming influence of the sun upon the earth is communicated to the layers of air near the surface, and they attain an excess of temperature which continues only through a small space upwards. The opposite effect occurs during a clear night, owing to the cooling of the earth's surface by radiation. It will be observed that these anomalies of temperature are favoured by a clear sky, and disappear either almost or altogether when it is cloudy.

Observations taken with the aneroid in frequent succession during the day's walk, and for comparison with each other, will be exempt from several of the sources of uncertainty which have been enumerated. But the fact of the observations not being simultaneous makes it especially necessary that an atmosphere settled, both as regards pressure and temperature, should prevail at the time; or, if the latter be an unattainable condition, that a suitable correction be estimated and made. If, for example, changes should be occurring, such that, supposing the observer, after reading the instrument at A and B, should then return to A and find a second reading taken there to differ materially from the previous reading, this would be a case in which the original pair of observations would be vitiated, unless indeed the barometric change should not have commenced until after the observer left B to return to A. To produce the above result, the weather must be in an unsettled state, and that is always a state unsuitable for hypsometrical observations. A change of temperature occurring at A or B in the interval between the observations is a difficulty incident to the most settled weather.

The precise extent to which it will affect the correctness of our results is a matter which must be left for future inquiry. My present object has been to invite attention to the conditions by which we are surrounded in the investigation and application of the hypsometrical formula, to take a passing survey of the ground, and by a slight skirmish to prepare the way, if it may be, for a future attack.

While it is an object worthy of attention to secure the utmost possible exactness for the formula, and to store up useful precautions for applying it, the sources of uncertainty here touched upon are not such as ought to discourage a course of observations with the aneroid. I trust, indeed, that we shall soon find this instrument*, with its construction still further improved, doing good service by helping to define the features of localities in which the nicer operations of trigonometrical survey would be at once difficult and superfluous.

* In the list of applications for patents, March 13, 1862, there is one from M. Vidi for "Aneroid Barometers."

2. CONTRIBUTIONS TO ALPINE HYPSONOMETRY, &c.

By F. F. TUCKETT, F.R.G.S.

THE MERCURIAL BAROMETER; BOILING-POINT THERMOMETER,
OR THERMO-BAROMETER; ANEROID; SYMPLESOMETER; ALPINE
MINIMUM THERMOMETER.

1. *Mercurial Barometer.*

OF this instrument it is unnecessary to say more than that, apart from its fragile character, there is none which is so thoroughly trustworthy and satisfactory for determinations of altitude in a mountainous country—none which rivals it in accuracy. The sources of error incidental to its results, and which have been so admirably handled by Professor Plantamour, of Geneva*, are equally efficient in the case of other hypsometers; whilst each of these has some special weak point peculiar to itself, and not possessed by the barometer. The liability to fracture, and inferior portability, are, however, objections which doubtless deter many from making it the companion of their travels, and, though habit does much to overcome the second of these defects, the other still exists in the case of most of the instruments supplied by the best makers, both in this country and on the continent. After some experience of different modes of construction and mounting, I have come

* "*Mesures Hypsométriques dans les Alpes, exécutées à l'aide du Baromètre.*" Genève, 1860.

to the conclusion, that the form adopted by Mr. Newman, late of Regent-street, as modified by his successors, Messrs. Negretti and Zambra, is, on the whole, the best adapted to the rough usage of Alpine travel. At any rate, one of this description which I have made use of for several years has stood all kinds of ill treatment, short of being actually thrown down on some hard surface, without injury. By a very pretty contrivance, its portability is secured without having recourse to the old bag-and-screw arrangement, and its construction admits of the emptying, re-filling, or entire removal of the cistern, which may be taken to pieces and cleaned with as much ease as a gun. Other instruments used for hypsometrical purposes only aim at determining indirectly what the barometer shows directly—viz., the atmospheric pressure in inches of mercury at any given time and place.

2. *The Boiling-Point Thermometer, or Thermo-barometer.*

In the narrative of an ascent of the Aletschhorn, in another part of this series, I have described a boiling-water apparatus, constructed for me by Mr. Stevenson, of Edinburgh, and which has for some years done duty, either for cooking purposes, or the determination of height by means of thermometers. The extreme portability of these instruments, and the wonderful accuracy with which they are turned out by such makers as Casella, and Negretti and Zambra, render them valuable for hypsometrical purposes. Possessing one or more thermometers, packed in brass tubes, and surrounded by vulcanized india-rubber, the traveller has always a second string to his bow, in case of the fracture of his barometer; and, so far as my experience goes, the results yielded are

susceptible of a high degree of accuracy. Prof. Forbes* advocated the use of the boiling-point thermometer in the measurement of heights, and expressed an opinion that, though inferior in accuracy to a good barometer, it was "a convenient and effective instrument," capable of furnishing results within fifty feet of the truth. Further remarks on its utility will be found in a paper by Prof. Christie, of the Royal Military Academy, printed in the "Phil. Trans.," part ii., 1846. Still more recently, the MM. De Schlagintweit, after repeated trials of the method in question, compared with the barometer up to a height of 19,323 feet in the Himalayas, have announced the result to be very satisfactory.† Forbes and Christie both give formulæ for obtaining the height from the boiling point, but, as they differ from one another, and Dr. Hooker‡ seems not to have found that of Prof. Forbes applicable to his Sikkim observations, I have made use of the excellent Tables of Regnault, revised by Moritz.§ In these will be found the barometric pressures, corresponding to the temperature of boiling water, as calculated by M. Regnault from his "Tables of Forces of Vapour," and first published in the "Annales de Chimie et de Physique," tom. xiv., page 206. As an instance, amongst many that I could cite, of the near correspondence of the "equivalent pressure" indicated by these Tables with that actually shown by the barometer, I may quote the following:—

Col de Lys.—Barometer (reduced), 456 millimètres. Re-

* In a paper, read before the Royal Society of Edinburgh in 1843, and printed in its "Transactions," vol. xv., page 411; and again, in a later one, entitled "Further experiments and remarks on the measurement of heights by the boiling-point of water," ("Trans. Roy. Soc. of Edin." vol. xxi., part 2, 1855.)

† See "Results of a Scientific Mission to India and High Asia," by H. A. and R. de Schlagintweit, vol. ii. Leipzig and London, 1862, pp. 22—35.

‡ "Himalayan Journals," vol. ii., page 456, 1st edition.

§ The "Smithsonian Miscellaneous Collections: Meteorological and Physical Tables, prepared by Prof. A. Guyot," 2nd edition, Washington, 1858.

sultant height, 14,053 feet. Boiling point (mean of two thermometers), $187^{\circ}42$ Fahr. = $86^{\circ}34$ C. = 456 \cdot 3 mil. (by Regnault's Table) = a height of 14,028 feet.

Again :—

Riffler Hotel.—Barometer (reduced), 561 \cdot 6 millimètres. Resultant height, 8497 feet. Boiling point (mean of two thermometers), $197^{\circ}25$ F. = $91^{\circ}81$ C. = 562 \cdot 66 mil. (Regnault) = 8458 feet.

Of course the best Tables in the world are of no avail against errors in the construction of the thermometer, but these are now produced in such perfection as to leave little to be desired on this head. It is due to Mr. Casella to state that, having had two instruments supplied by him and graduated to $0^{\circ}1$ and $0^{\circ}2$ Fahr., in constant and simultaneous use during the summer of 1861, and at altitudes of from 4,000 to 14,000 feet, the *greatest* difference noted in their readings throughout the scale amounted to only $0^{\circ}15$ Fahr., and rarely exceeded $0^{\circ}05$.

I hope, then, that I may have said enough to induce those who carry a barometer to add one or more boiling-point thermometers and a boiling-water apparatus to their equipment; and the still larger number of mountaineers, whose telescopes and spectacles are at present their only scientific apparatus, to furnish themselves, in future, with at least this very slight incumbrance.

3. Aneroid Barometer.

If the portability of this beautiful instrument were at all equalled by its hardiness and accuracy, it would be invaluable to the mountaineer, and, probably, take precedence of every other form of hypsometer. Till

recently, however, the attempts to impart a high degree of accuracy to its indications at low pressures have met with very limited success, the most fatal objection appearing to be the uncertainty of its restoration to its normal condition after being exposed to extreme variations of pressure, which seem to affect the elasticity of the metal. Within the last year or two, however, Messrs. Lerebours and Secretan, of Paris, have produced an aneroid for mountain purposes, at the moderate price of 100 francs (including detached thermometer and leather sling case), which, so far as I have had an opportunity of observing it, appears to have attained a very greatly increased precision. Further observations will test this favourable opinion, and ascertain whether it develops ability to recover itself and record accurately high pressures, after exposure on mountain summits to low ones. I have not yet had an opportunity of using my own instrument in the Alps, but one in the possession of my friend, the Rev. C. Hudson, performed very satisfactorily, up to heights of 11,000 feet, in July, 1861. Dr. Kolb, of Paris, has kindly furnished me with two readings of another of these instruments belonging to him. The first, taken on the Alphubel Joch, gives a resultant height of 12,663 feet, which agrees very fairly with that deduced by me for the same spot, about two months previously, from the means of my two boiling-point thermometers, viz., 12,575; the second, taken on the summit of Monte Rosa, makes the height 15,734 feet, or 517 in excess of the determination of the Federal engineers. As the second observation followed the first with an interval of only one day, it is possible that the instrument did not regain its elasticity after exposure to the low pressure of 484 millimètres on the Alphubel Joch, and, as a necessary consequence, gave too low a reading (432 millimètres) on Monte Rosa. Further

experiments are needed to settle the point, and as, after all, the instrument is scarcely more expensive than the common "trade aneroid," I should hope that intending purchasers will invest in one of Lerebours' make, using it at home as an ordinary, but unusually excellent, weather-glass, and taking it with them when next they start for the mountains. My instrument ranges from 340 to 800 millimètres (13,386 to 31,497 inches), which more than suffices for the loftiest European mountains. It is graduated to millimètres, but as small an amount as a tenth of one of these may be estimated correctly by making use of the glass-bevel to superimpose an image of the scale and point of the needle so as to avoid all error from parallax.

4. *Sympiesometer.*

As this instrument is less commonly in use than those already referred to, I will quote, for the information of those who are unacquainted with it, the following details of its construction from Drew's "Practical Meteorology:"—"In the sympiesometer of Mr. Adie, of Edinburgh, a portion of air, or hydrogen gas, is compressed into a small chamber by the pressure of the atmosphere on the surface of fluid glycerine. A glass tube, nine to eighteen inches in length, terminated upwards by a bulb, and at the lower end by a cistern, is partly filled with oil or coloured sulphuric acid (or glycerine). The fluid, on being urged upwards by the atmospheric pressure, compresses the air in the upper part of the tube into a space varying with the amount of pressure. To correct the error which would arise from the change in volume of the enclosed air or gas due to variations in the temperature, the scale which

carries an index is moveable, and, before reading off, the index must be brought on a second and parallel scale, divided *thermometrically*, to correspond with the temperature of the instrument, as shown by an attached thermometer. The pressure is then at once obtained by reading off from the barometrical scale the number of inches and parts of inches, corresponding with the top of the column of coloured fluid."

The sympiesometer, though admitted to be extremely sensitive, and frequently used at sea, was, I believe, never put forward by its inventor as claiming a *high* degree of accuracy as a *scientific* instrument, and its liability to derangement, when exposed to rough usage, led to its undeserved neglect, even as a subsidiary aid in hypsometrical determinations. Within the last year or two, Mr. L. P. Casella has given much attention to its construction, and, though I am not prepared to say that the problem is yet solved by the production of an instrument whose indications may be implicitly relied on, like those of the barometer, even at the lowest pressures, he has already met with a degree of success sufficient to justify the hope that the sympiesometer will ere long take rank as a scientific instrument. Those with which Mr. Casella has supplied me have, during the last two years, been tested by many hundred comparisons with the barometer at all attainable altitudes, from the sea-level to the summit of Mont Blanc, and, though still leaving much to be desired, give results of considerable value, and very fair accuracy, up to a height of 7000 or 8000. As a chronometer, with an uniform rate of gain or loss, is quite as valuable as one which indicates time with absolute accuracy, so an instrument the errors of which are not capriciously distributed over the scale, but increase regularly in the same direction, may yield as good results as if the errors had no existence.

Now, after taking into account a certain index correction applicable, in the first instance, to all hypsometrical instruments, I found that Mr. Casella's sympiesometer gave readings very fairly accordant with those of the barometer up to a height of about 8000 feet. Above this altitude, there was an error in excess of about .1 inch for every thousand feet of increase in height; consequently, my readings on such lofty points as the summit of Mont Blanc, the Signal Kuppe of Monte Rosa, and others, were much too high, and the resultant altitudes of course too low, to a corresponding extent. Applying the correction, however, obtained by numerous comparisons, the discrepancies diminished very considerably, and, though the instrument will never rival the barometer in accuracy, I am still inclined to think that my experience of its use is sufficiently satisfactory to warrant a further trial. There is another point of view from which the merits of the sympiesometer may be discussed, and which, in conclusion, I proceed to state. Granting, for a moment, that reliance cannot be placed upon it for the exact determination of differences in level of many thousand feet, especially at extreme pressures, it may yet give very good results when the difference is limited to 1000 feet or less. Now, there are few passes which have not in their immediate neighbourhood some accessible peak the height of which has been determined, and, on the other hand, there are, in the vicinity of most peaks, passes the altitude of which is known. In such cases, the sympiesometer, whilst unreliable for the determination of absolute elevation, may suffice for that of comparatively small differences of height, and, by subtracting the difference so found from the known height of the peak, that of the pass is arrived at, and, similarly, *vice versa*. To cite an example:—On the 25th of June, 1861, at 9.30 A.M., I took a sympiesometer reading on

the Tête Blanche, which, by comparison with the St. Bernard, gives a height of 11,937.2 feet. This result is considerably below the mark, as we happen to know from other sources; but, even did we not possess this check, we have the means of ascertaining the amount of error and eliminating it by the application of a most simple correction. At 8 A.M. the same day, or an hour and a half previously, I had also observed the instrument on the Col d'Erin, the height of which is 11,408 feet, according to the Federal surveyors. According to the sympiesometer, however, it is only 11,034.6, a difference of 373.4 feet. Apply the error in the altitude deduced from the Col reading as a + correction to the height of the Tête Blanche, and we get $11,937.2 + 373.4 = 12,310.6$ feet. Now, the Federal surveyors give it as 12,304, and the corrected result obtained from the sympiesometer observation is, therefore, less than 7 feet in excess of the truth. If, again, we take the observation on the Col as our point of departure and compare that on the Tête Blanche directly with it instead of with the St. Bernard, we get a difference in height of 887 feet. Adding this to the known altitude of the Col, 11,408, we have for that of the Tête 12,295, or only 9 feet less than the determination of the Federal engineers—a variation which, small as it is, may have been partly caused by the two observations not being simultaneous.

5. *Alpine Minimum Thermometer.*

In the "Bibliothèque Universelle de Genève," for September, 1861, will be found an interesting report of a committee charged by the "*Société Helvétique des Sciences Naturelles*," at the instance of the Federal Government, with the consideration of the establishment of a series of meteorological stations in Switzerland, and the character

of the observations to be made. The propositions of the committee were adopted by the society at its annual meeting at Lausanne, and it is probable that, before long, the measures advocated will be in practical operation. Already observers are forthcoming for eighty-three stations, fifty of which are situated at an altitude of from 200 to 800 mètres (= 656 to 2625 English feet), whilst the remaining thirty-three range from 800 to upwards of 2600 mètres (= 2625 to 8530 feet). The observations will embrace, *a.* atmospheric pressure, *b.* temperature, *c.* humidity, *d.* direction and force (approximative) of wind, *e.* rain and snow fall, *f.* aspect of the sky, *g.* abnormal phenomena, *h.* the principal epochs of vegetation. Lastly, it is proposed that two stations, Berne and the St. Gotthard, shall be furnished with complete self-registering apparatus, so as to compensate as far as possible for the want of coincidence with the most suitable hours of observation in the case of the subordinate stations. These two fundamental stations would thus bear to one another, and to subordinate ones in Central Switzerland, the same relation as Geneva and the St. Bernard to the western portion of the country. We may thus hope, ere long, to obtain most valuable additions to our knowledge of Alpine meteorology. But, in reading the report of the Commission, one is struck by the absence of any proposal for the registration of the winter minimum cold at extreme altitudes — a subject of greater importance, in relation to more than one scientific question, than might at first be supposed. I believe I am correct in saying that no recorded observations existed of the minimum temperature of the year at any European station more elevated than the Great St. Bernard, until the committee of the Alpine Club, desirous of utilizing the performances of the members for scientific purposes, invited cooperation in a plan for depositing registering thermometers at various points in

the chain of the Alps, and at the greatest attainable altitudes. The proposal met with a favourable reception, and, during the summer and autumn of 1860—1861, twenty-four instruments, constructed by Mr. Casella, have been placed at heights varying from 7150 to 15,784 feet, distributed over the Cottian, Graian, Pennine, and Bernese Alps, from Monte Viso in the S.W., to the Finisteraarhorn in the N.E., and even as far as the Marmolata in the southern Tyrol, though this is not connected by any intermediate link with the Bernese stations.

From causes, the origin of which is still involved in some degree of uncertainty, many of these instruments have become useless from the division of the column of spirits and the introduction of air bubbles, which, though easily removed by a smart jerk, of course vitiate the reading. From experiments made in England, consisting in the alternate exposure of the thermometers to varying temperatures, I am inclined to attribute the occurrence in question to the operation of this cause, which must be especially energetic at great altitudes. There is, I think, little doubt that, unless the thermometer be carefully shielded from the influence of radiation by night, and the direct action of the sun's rays during the day—conditions not easy of fulfilment, when each observer is anxious to be as little encumbered, and to set up his instrument as rapidly as possible—it may be subjected to variations of temperature, in twenty-four hours of fine winter weather, not less in amount than 100° Fahr. If this or even a more limited range be made use of, my experiments show that a solution of continuity in the column, or a "state of bubbles," as it is commonly called, will result. Either, then, more care must in future be taken to protect the instruments from the sources of disturbance, or some form of *mercurial* minimum thermometer must be adopted in place of the

ordinary *spirit* minimum known as Rutherford's, which has hitherto alone been used. For this purpose, Mr. Casella's new patent seems admirably adapted, the only objection being its greater size and expense, the limitation of the range to the freezing point of mercury, and the instability of the column. Of all the changes which the spirit in these Alpine thermometers has undergone, the most curious is that recorded in the case of the Monte Rosa minimum, by my friend, Dr. Kolb. He informs me that he carefully examined the tube, on the occasion of his ascent in August, 1861, but could discover *no trace whatever of spirit, nor any indication of fracture in the glass by which it could have escaped*. The index lay high and dry on the bottom of the bulb. Unless Dr. Kolb laboured under some strange mistake, I confess I am at a loss to account for so extraordinary a result, which he attributes to "a sort of volatilization of the contained spirit." It may not, however, be amiss to cite here, in connection with this subject, a remark of Dr. Hooker's*, whose accuracy is unimpeachable:—"The spirit minimum thermometers are easily set to rights when out of order, but in every one (six or seven) which I took to India, by several makers, the zero point receded, the error in some increasing annually even to -6° in two years. *This seems due to a vaporization of the spirit within the tube*. I have seen a thermometer of this description in India, *of which the spirit seemed to have retired wholly into the bulb*, and which, I was assured, had never been injured."

Leaving the further discussion of the question to more competent hands than mine, it only remains for me to give a list of the stations, and to express, on behalf of the committee of the Alpine Club, my thanks to those gentlemen

* "Himalayan Journals," vol. ii., Appendix A, page 358, 1st edition.

who have either deposited thermometers, or furnished us with observations of those previously set up, and to solicit further assistance under both these heads. The instruments should be *touched* by none but those who understand their use and construction, and know how to re-set them, but may be *read off* by anyone who will kindly take the trouble.

N.B. Should the column of spirit become separated, hold the thermometer bulb downwards, and one or two good swings of the arm will reunite it. To bring the index out of the bulb, or re-set the instrument, hold it bulb upwards. The lowest temperature is that degree of the scale indicated by the end of the little glass index which is farthest from the bulb.

Stations at which Minimum Thermometers have been placed.

Name of Station.	Height.	No. of Ther.	Position.	By whom Placed	Date of Deposit.	Lowest Temp. recorded.	By whom Observed.	Date of Observation.	Remarks.
Mont Blanc .	15,784	?	Pennine Alps	Prof. Tyndall	Aug. 21, 1859	Centigrade. -14° 8'	W. Mathews, junr.	Aug. 29, 1859	1861, July 19, F. F. Tuckett: "spirit separated." Sept., F. W. Jacomb: "spirit separated."
Monte Rosa (Höchste Spitze)	15,217	316	"	Col. Robertson	July 16, 1860	-17°	T. Blandford	Aug. 30, 1860	1861, Aug. 10, Dr. Kolb: "all the spirit had disap- peared; no flaw visible; index on bottom of bulb."
" Nordend .	15,132	?	"	Sir T. F. Buxton	Aug. , 1861	"	"	"	No record since deposit.
Finsteraarhorn .	14,046	318	Bernese	F. F. Tuckett	July 27, 1860	-10°	T. Blandford	Aug. 7, 1861	Reset two days before by Rev. L. Stephen. Aug. 23, P. H. Lawrence: "no in- dex visible."

Name of Station.	Height.	No of Pier	Position.	By whom Placed.	Date of De- posit.	Lowest Temp. record- ed.	By whom Ob- served.	Date of Ob- servation.	Remarks.
Finsteraarhorn . . .	213		"	Rev. L. Stephen	Aug. 5, 1161	Centi- grade, -7° 25°	P. H. Lawrence	Aug. 25,	
Corridor (Mt. Blanc)	14,000	?	Pennine	Prof. Tyndall	Aug. 21, 1859				No record since deposit.
Castor . . .	13,879	376	"	W. Mathews and F. W. Jacomb	Aug. 23, 1861				" "
Grand Paradis	13,300	367	Graian	F. F. Tuckett	July 3, 1861				" "
Grand Plateau (Mt. Blanc)	12,900	?	Pennine	Prof. Tyndall	Aug. 21, 1859	- 7°	W. Mathews, junr.	Aug. 29, 1859	No record since 1859.
Col d'Argentiere . .	12,600	314	"	F. F. Tuckett	Aug. 2, 1860	- 35°	S. Winkworth	June 22, 1861	"Index indicated -46°; spirit separated from + 21° 5 to + 32° 5." The result is, therefore, doubt- ful.
Monte Viso . . .	12,586	301	Cottian	Messrs. Mathews and Jacomb	Aug. 30, 1861				No record since deposit.
Aiguille du Gouté .	12,530	372	Pennine	F. F. Tuckett	July 17, 1861				In Sept., F. W. Jacomb could not find the instru- ment.

Name of Station.	Height.	No. of flc	Position.	By whom Placed.	Date of De- posit.	Lowest Temp. record- ed.	By whom Ob- served.	Date of Ob- serva- tion.	Remarks.
La Sassière .	12,400	302	Graian Alps	W. Mathews, jun.	Aug. 5, 1860	Centl. grade.	.	.	No record since deposit.
Oberaarhorn .	11,923	?	Bernese	Rev. L. Stephen	Aug. , 1860	.	J. K. Stone	Aug. , 1860	"Spirit separated."
Trift Joch .	11,601	333	Pennine	Rev. T. G. Bon- ney	Sept. , 1860	- 9°	Rev. C. H. Pil- kington	Aug. 17, 1861	"Spirit separated in two places."
Mont Gelé .	11,539	384	"	F. W. Jacomb	Aug. 11, 1861	.	.	.	No record since deposit.
Col d'Erin .	11,408	318	"	F. F. Tuckett	July 18, 1860	- 21°	A. P. Whately	Aug. 19, 1861	"In good order, and agreed with the reading of an- other instrument."
Marmolata .	11,300	?	S. Tyrol	J. Ball	, 1860	.	.	.	No record since deposit.
Mettelhorn .	11,190	?	Pennine	Rev. L. Stephen	, 1860	.	.	.	"
Grauhaupt .	11,030	335	"	A. T. Malkin	Aug. 23, 1860	- 1°7	F. J. A. Hort	Sept. 5, 1860	No record since 1860.
Becca di Nona .	10,382	306	Graian	"	Aug. , 1860	- 27°	M. Carrel	June 27, 1861	.
Col de Chermone- tane	10,349	?	Pennine	Buxtons and Cowell	Aug. , 1861	.	.	.	No record since deposit.
Äggischhorn Peak	9,649	312	Bernese	F. F. Tuckett	July 24, 1860	- 9°	T. Webster	Sept. 9, 1860	1861, July 4, W. G. Fry "could not find it, and be- lieved it had been broken."

Name of Station.	Height.	No. of Ther.	Position.	By whom Placed.	Date of Deposit.	Lowest Temp. recorded.	By whom Observed.	Date of Observation.	Remarks.
Faulberg Cave	9,150	315	"	"	July 26, 1860	Centigrade -12°5	T. Blandford.	Aug. 6, 1861	"Index close to bulb, and evidently not properly set when deposited." No record since deposit.
Glacier des Bossons	?	?	Pennine	*Prof. Tyndall.	Aug. 21, 1859	.	W. Mathews, junr.	Aug. 29, 1859	
Faulhorn	8,804	?	Bernese	E. Anderson	Sept. , 1860	.	.	.	
Aeggischhorn Hotel	7,150	310	"	F. F. Tuckett	July 24, 1860	- 2°	F. J. A. Hort	Sept. 27, 1860	No record since 1860.

• This thermometer was given by Professor Tyndall to Auguste Balmat with instructions to place it on the Glacier des Bossons.

CHAPTER XV.

TABLES OF THE HEIGHTS OF PEAKS AND PASSES.



1. INTRODUCTORY REMARKS.
2. TABLE OF ALPINE PEAKS.
3. TABLE OF ALPINE PASSES.
4. TABLE OF PYRENEAN PEAKS.

1. INTRODUCTORY REMARKS.

In the following tables an attempt has been made to correct and extend the list which appeared in the first series of "Peaks, Passes, and Glaciers," with the view of presenting, in as complete yet condensed a form as possible, the heights of the loftiest or most familiarly known Peaks and Passes of the Alps.

All Cols below 9000 feet (2743 metres) have been omitted, partly in order to confine the number within moderate limits, and partly because the required information may, in their case, be generally found in guide-books. For similar reasons, it has been decided to exclude from the list of Peaks all but the most prominent or characteristic of each group.

I am well aware of the impossibility of attaining to anything like absolute accuracy in these matters, especially as the topography and hypsometry of several of the districts (such as the Cottian and Dauphiné Alps, for instance) are still most imperfect. I have, however, used my best endeavours, by careful sifting of evidence, and the use of the most trustworthy authorities, to reduce the avoidable errors to a minimum.

Besides the systematic hypsometrical collections of Osterwald and Ziegler, and the still more extensive one of Durheim, recourse has been had to the works of Berlepsch, Carrel, Forbes, Plantamour, De Saussure, the brothers Schlagintweit, the Studers, Von Tschudi, Ulrich, and Von Welden. Use has also been made of the "*Quadro di Altezze*," in "*Le Alpi che cingono l'Italia*," of the geodetical volume of the "*Opérations pour la mesure d'un arc du Parallèle moyen*," and, lastly, of the admirable series of Federal maps now in course of execution, under the direction of General Dufour.

To M. Bétemps, the engineer charged with the execution of Sheet XXIII. of this survey (comprising the valleys of Zermatt and Saas), I am indebted for much interesting and as yet unpublished matter, and I have also to thank my friend Mr. W. Mathews for a large number of most valuable contributions, as well as for assistance in revision and arrangement.

Should those who may make use of these tables detect any inaccuracies, they would confer a great favour by pointing them out, and at the same time supplying, if possible, the means of correction.

F. F. TUCKETT.

TABLES OF ALPINE PEAKS AND PASSES.

2. TABLE OF

(Those preceded by an

Name of Mountain.	Position.	Height in Eng. ft.	Height in metres.
MARITIME ALPS (<i>Mediterranean</i>)			
1. *Rioburent	Lat. 44° 37' 3", Long. 4° 37' 14" E. of Paris.	11,053	3369
COTTIAN ALPS (<i>Monte Viso to the Levanna</i>)			
1. *Monte Viso	Lat. 44° 39' 45"; Long. 4° 45' 5" E. of Paris.	12,586	3836
2. *La Levanna	Head of Val d'Orca, S. of Ceresole .	12,020	3663.5
3. *Roche Melon	Lat. 45° 12' 5", Long. 4° 44' 54" .	11,606	3537.5
4. *Roche St. Michel	? „ 45° 14' 29", „ 4° 40' 44" .	11,477	3498
5. *Mont d'Ambin	„ 45° 9' 17", „ 4° 33' 19" .	11,092	3380.9
6. *Monte Meidassa	„ 44° 42' 55", „ 4° 44' 38" .	10,991	3350
7. *Roche Brune	„ 44° 49' 20", „ 4° 27' 5" .	10,909	3325
8. *Mont Tabor (or Thabor)	? „ 45° 6' 43", „ 4° 14' 5" .	10,436	3181
DAUPHINÉ ALPS (<i>from Pic du Frêne southwards</i>)			
1. Pic d'Aléfroide (Aléfred)	S.W. of Pelvoux	? 13,468	4105
2. Grand Pelvoux, *Pic d'Arcine or d'Arsines.	Head of Val Louise	? 13,200	4018.5
Grand Pelvoux, Pic du Py- ramide.	. . . . .	? 13,050	3971
*Grand Pelvoux de Val Louise	? Lat. 44° 53' 56", Long. 4° 3' 52" E. of Paris.	12,907	3934
3. Aig. du Midi de la Grave (La Meidje).	? Lat. 45° 0' 18", Long. 3° 58' 20" E. of Paris.	13,078	3986
4. Montagne d'Oursine . . . .	. . . . .	12,930	3941

ALPINE PEAKS.

asterisk have been ascended.)

Authority.	Method.	Remarks.
<i>to southern base of Monte Viso).</i>		
E. M. P. (État Major Piémontais.)	Bar.	"Le Alpi che cingono l'Italia."
<i>inclusive, and westwards as far as Mont Tabor.)</i>		
Corabœuf	Δ	Mathews (Bar). 12,668; E. M. P. ("Le Alpi"), 12,599. (Minimum Thermometer, No. 301.)
Cowell,	Boiling point	
Mean	Δ	E. M. P. ("Le Alpi") 11,621, Von Welden, 11,592.
"	Bar.	Brousseau ("Durheim"), 11,493; De Saussure ("Voyages"), 11,460.
Austrian and Sardinian Engineers.	Δ	"Mesure d'un arc du parallèle moyen."
E. M. P.	Bar.	"Le Alpi."
Statistica della Francia .	Δ	"
Austrian and Sardinian Engineers.	Δ	"Mesure d'un arc."
<i>W. of the Arc, Val de Valloire, and the Durance).</i>		
French Engineers . . .	Δ	13,708 ("Carte Géol. du Dauphiné, par Ch. Lory"). ?
Whymper	Estimate	Carlini and Plana, 13,452; Von Welden, 13,444 (Forbes' "Excursions").
Whymper	Estimate	
Statistica della Francia .	?	"Le Alpi che cingono l'Italia." Lory, 12,917.
"	Δ	"Le Alpi," and Prof. Lory.
Von Welden	Δ	"Der Monte Rosa," 12,930, as Mont d'Oursine; "Le Alpi," 12,930, as Pointe du Grand Glacier.

TABLE OF ALPINE PEAKS.

Name of Mountain.	Position.	Height in Eng. ft.	Height in mètres.
DAUPHINÉ ALPS (<i>from Pic du Frêne southwards.</i>)			
5. Pointe du Grand Glacier	N. of St. Christophe	?	?
6. Aig. d'Arve (Les trois Elions)	? Lat. 45° 7' 39", Long. 4° 0' 1" E. of Paris.	11,519	3511
7. Mont Goleon de la Grave	? Lat. 45° 6' 12", Long. 3° 59' 24" E. of Paris.	11,250	3429
8. Mont du Grand Chaillot	? Lat. 44° 45' 0", Long. 3° 48' 58" E. of Paris.	10,896	3321
9. Mont Muan de Bellone	? Lat. 44° 49' 0", Long. 3° 45' 14" E. of Paris.	10,889	3319
10. Vieux Chaillot	? Lat. 44° 44' 10", Long. 3° 57' 13" E. of Paris.	10,391	3167
11. Les Grandes Rousses	? Lat. 45° 7' 12", Long. 3° 39' 5" E. of Paris.	9,977	3041
12. *Pic du Frêne	Lat. 45° 21' 2", Long. 3° 52' 8" E. of Paris.	9,203	2805
GRAIAN ALPS (<i>Levanna to Col de la Seigne, N. of the Arc</i>)			
1. *Grand Paradis (Mont Iséran ?).	Head of Val Savaranche, S. of Grivola.	13,300	4054
2. *La Grivola (Cornede Cogne)	Between Val Savaranche and Cogne, S.W. of Aosta.	13,005	3964
3. *Mont Pourri, *N. Peak	Between Val de Tignes and Val de Peisey.	12,800	3901.5
*S. Peak	Between Val de Tignes and Val de Peisey.	11,769	3587
4. *La Grande Casse (Aig. de la Vanoise).	N.E. of Col de la Vanoise	12,780	3895.5
5. *La Sassiére	E. of Tignes	12,343	3762
6. Dent Parassée		12,137	3699.5
7. Le Grand Apparei	S. of Col de Gailletta	12,000	3657.5
8. *Mont Emilius	? Lat. 45° 40' 38", Long. 5° 3' 20"	11,788	3593
9. Ruitor, S. Peak	Between Val d'Aosta and Val de Tignes.	11,400	3474.5
*N. Peak	Between Val d'Aosta and Val de Tignes.	11,339	3456
10. *Monte Ormelune	Between Val Grisanche and Val de Tignes.	10,833	3302
11. *Roche Chévière	Lat. 45° 17' 29", Long. 4° 23' 34"	10,765	3281
12. *Becca di Nona	S. of Aosta	10,384	3165

Authority.	Method.	Remarks.
<i>of the Arc, Val de Valloire, and the Durance</i>)—continued.		
- . . . .	. . .	"Le Alpi." Height uncertain. Confused with Mont d'Oursine.
tistica della Francia .	Δ	" "
tistica della Francia .	Δ	" "
lars . . . . .	. . .	" "
érin . . . . .	. . .	" "
atistica della Francia .	. . .	" "
éricart de Thury . . . . .	. . .	" " Forbes ("Excursions in Dauphiné") gives 11,900.
M.P.	Δ	"Mesure d'un arc du parallèle moyen."

d Val di Locana, and S. of Val d' Aoste).

Barometrical	Boiling point	Austrian Engineers (Von Welden)
buckett		13,275; Corabœuf 13,271, for Iséran (Minimum Thermometer, No. 367).
Barrel	Δ	
Mathews	Estimate	Probable height from 12,700 to 12,900.
"	Bar.	
"	Bar.	Aig. de la Vanoise 12,674. Corabœuf.
Corabœuf	Δ	Mathews (bar.) found 12,308. (Minimum Thermometer, No. 302.)
Von Welden	Δ	"Der Monte Rosa."
Mathews	Estimate	
Carrel	Δ	11,804, E.M.P., "Le Alpi." Bar.
Mathews	Estimate	
"	Bar.	
E.M.P.	Bar.	"Le Alpi."
"	Δ	"Mesure d'un arc du parallèle moyen."
Carrel	Δ	(Minimum Thermometer, No. 306.)

Name of Mountain.	Position.	Height in Eng. ft.	Height in mètres.
PENNINE ALPS (<i>from Col du Bonhomme</i>)			
1. *Mont Blanc	Savoy	15,784	4811
	.		
*Dôme du Goûté	N.W. of Mont Blanc	? 13,294	? 4052
*Aiguille du Goûté	N.W. of Dôme	12,530	3819
2. *Monte Rosa. *Höchste Spitze	Vallais and Piedmont	15,217	4638
*Nord End	N. of Höchste Spitze, S. of Weisssthor	15,132	4612
*Zumstein Spitze	S. of Höchste Spitze	15,004	4573
*Signal Kuppe	S.E. of Zumstein Spitze	14,964	4561
Parrot Spitze	S.W. of Signal Kuppe, E. of Lys Joeh	14,577	4443
*Ludwigshöhe	S.W. of Parrot Spitze	14,187	4324
Schwarzhorn	S.W. of Ludwigshöhe	14,092	4295
Balmenhorn	S.W. of Schwarzhorn	13,927	4245
*Vincent Pyramide	S. of Balmenhorn, N. of Col delle Piscie.	13,859	4224
Mischabel-Hörner, *Dom . .	Between valleys of Zermatt and Saas	14,935	4552
„ Täschhorn	S.S.W. of Dom	14,758	4498
„ *Gasenriedhorn (No. 1. Nadelgrat	N. of Dom	14,219	4334
„ Nameless (No. 2. Nadelgrat)	N.E. of Dom	14,108	4300
4. *Lyskamm	W. of Monte Rosa and Lys Joeh .	14,889	4538
5. *Weisshorn	Between valleys of Zermatt, Einflisch, and Turtmann.	14,804	4512
Bruschegghorn (Bruneckhorn)	N.E. of Weisshorn	12,618	3846
Ausser Barrhorn	N.N.W. of Bruschegghorn	11,919	3633
6. Matterhorn (Mont Cervin) .	S.W. of Zermatt, N.W. of St. Théodule Pass.	14,705	4482
7. Dent Blanche	Between valleys of Zmutt, Zinal, and Evolena	14,318	4364
8. *Grand Combin (Graffèneire)	Between Val d'Entremont and Val de Bagnes	14,164	4317

Authority.	Method.	Remarks.
<i>and Col de la Seigne to the Pass of the Gries).</i>		
Mean	Δ , Bar. &c.	(Minimum Thermometer.) 15,784, De Candolle; 15,784, Roger; 15,784, French, Sardinian, and Austrian Engineers; 15,781, F. E. Dufour's "Atlas der Schweiz" (Blatt 22).
Bravais and Martins	Bar.	Probably an error. The height must be greater. Durheim.
Tuckett	Boiling point.	Mean of 4 obs. De Saussure gives 12,196 for the point he reached, not the summit.
F. E. <i>i.e.</i> Federal Engineers	Δ	Bétemps (Minimum Thermometer).
"	Δ	" "
"	Δ	" "
"	Δ	" "
"	Δ	" "
"	Δ	" "
Schlagintweit	Bar. &c.	" Neue Untersuchungen."
"	"	" "
"	"	" "
F. E.	Δ	Bétemps.
"	Δ	"
"	Δ	"
"	Δ	"
"	Δ	"
"	Δ	"
"	Δ	"
"	Δ	"
"	Δ	Dufour's "Atlas der Schweiz" (Blatt 18).
"	Δ	Bétemps. Dufour's "Atlas der Schweiz" (Blatt 22).
"	Δ	Bétemps. Dufour's "Atlas der Schweiz" (Blatt 22).
"	Δ	Dufour's "Atlas der Schweiz" (Blatt 22).

Name of Mountain.	Position.	Height to Eng. ft.	Height to mètres.
PENNINE ALPS (<i>from Col du Bonhomme and</i>			
9. Zwillinge (Jumeaux), *S. Peak, Castor.	W. of Lyskamm and Zwillinge Joch	13,879	4220
N. Peak, Pollux .		13,432	4094
10. Rothhorn (Moming) . .	N.W. of Zermatt, S.S.E. of Zinal .	13,855	4223
Trifthorn . .	N. of Triftjoch, S.W. of Rothhorn .	12,261	3737
11. Aiguille de Trelatête . .	S.W. of Mont Blanc, N.E. of Col de la Seigne	13,845	4220
12. *Alphubel	S. of Täschhorn, S.W. of Fée . .	13,803	4207
13. *Rympfischhorn	E. of Zermatt, N. of Adler, and S. of Allelin Pass	13,790	4203
14. *Strahlhorn	E. of Zermatt, S.E. of Adler, and N. of New Weiss Thor.	13,750	4191
15. Dent d'Hérens	W. of Matterhorn, S.E. of Col de Valpelline.	13,714	4180
16. *Breithorn	W.N.W. of Zwillinge and Schwarz Thor.	13,685	4171
17. Grandes Jorasses	Head of Gl. de Léchaud, E. of Mont Mallet.	13,496	4113
18. Aiguille Verte	Between Mer de Glace and Gl. d'Ar- gentière.	13,432	4094
Aiguille du Dru	W. of Aiguille Verte	12,500	3810
19. Gabelhorn (Ober)	W. of Zermatt, S.W. of Triftjoch .	13,363	4073
20. *Allelinhorn	E. of Alphubel Joch, N. of Allelin Pass and Rympfischhorn.	13,235	4034
21. *Weissmies	E. of Saas, between it and the Simplon	13,225	4031
22. Aiguille d'Argentières . .	S.E. of Argentières, between Gl. d'Ar- gentière and du Tour.	13,186	4019
23. *Fletschhorn, S. Peak, La- quinhorn	N. of Weissmies, N.E. of Saas, S. of Simplon Hospice.	13,176	4016
*N. Peak, Ross- bodenhorn	N. of Laquinhorn	13,084	3988
24. Aiguille du Géant	W. of Grandes Jorasses, N.E. of Col du Géant.	13,099	3992.5

Authority.	Method.	Remarks.
<i>Col de la Seigne to the Pass of the Gries</i>) — continued.		
F. E.	Δ	(Minimum Thermometer, 376.) Bétemps. Mathews (Bar.) found from Geneva 13,900, Turin 13,877, St. Bernard 13,855.
"	Δ	Bétemps.
"	Δ	Bétemps. Dufour's "Atlas der Schweiz" (Blatt 22).
"	Δ	Bétemps. Dufour's "Atlas der Schweiz" (Blatt 22).
Malten	?	Durheim's "Hypsométrie."
F. E.	Δ	Bétemps.
"	Δ	"
"	Δ	"
"	Δ	" Dufour's "Atlas der Schweiz" (Blatt 22).
"	Δ	"
Forbes	Δ	"Travels in the Alps."
"	Δ	" "
"	Δ	" "
F. E.	Δ	Bétemps. Dufour's "Atlas der Schweiz," (Blatt 22.)
"	Δ	"
"	Δ	"
Mean	Δ and G.	Pictet, 12,884; Schnuckburgh, 13,397; Chaix, 13,068 (Durheim).
F. E.	Δ	Bétemps. 4025, Dufour's "Atlas der Schweiz" (Blatt 18).
"	Δ	" 3917, Dufour's "Atlas der Schweiz" (Blatt 18).
Forbes	Δ	"Travels in the Alps."

Name of Mountain.	Position.	Height in Eng. ft.	Feet meters
PENNINE ALPS (<i>from Col du Bonhomme</i>).			
25. Mont Mallet . . .	E.N.E. of Aig. du Géant, S. of Tacul	13,058	3981
26. Grand Cornier . . .	N. of Dent Blanche.	13,022	3968
27. *Grand Plateau . . .	N. of Mont Blanc, E. of Dome du Gouté.	12,900	3931
28. *Ulrichshorn (Kleine Mischabelhorn).	W. of Saas, N.E. of Nadelgrat .	12,891	3920
29. Pointe des Plines . .	Head of Glaciers de Salena and du Tour.	12,835	3902
30. *Aiguille du Midi . .	S.S.E. of Chamouni, N.N.E. of Mont Blanc.	12,822	3900
31. *Petit Mont Cervin . .	W. of Breithorn, E. of Col de St. Théodule.	12,749	3888
32. Mont Blanc de Cheillon .	W. of Pigne d'Arolla, E. of Val de Bagnes.	12,700	3871
33. Cime des Fours . . .	N. of Col des Fours . . .	12,615	3845
34. Mont Dolent . . .	Head of Glacier d'Argentière, S. of Glacier de Laneuva.	12,566	3829
35. *Cima di Jazi . . .	N.N.E. of Monte Rosa, S. of Stralhorn.	12,527	3833
36. Pigne d'Arolla (Pigno de l'Arolla).	Head of Glaciers de Breney and d'Otemma.	12,471	3812
37. Dents de Bertol (or des Bouquetins).	E. of Mont Collon, W. of Tête Blanche.	12,412	3778
38. Balferinhorn . . .	N. of Kl. Mischabel (Ulrichshorn) and Col de Ried.	12,402	3775
39. *Mont Vêlan . . .	E. of St. Bernard, S.S.W. of Grand Combin.	12,353	3756
40. *Tête Blanche . . .	N.W. of Dent d'Hérens, S.W. of Col d'Erin.	12,304	3759
41. Mont Collon . . .	Head of W. Eringenthal, N.W. of Col de Collon.	12,264	3728
N. Peak . . .	. . . . .	11,956	3644
42. Petite Jorasse . . .	N.N.E. of Grandes Jorasses . .	12,246	3703
43. *Petit Combin (Combin de Corbassière).	N. of Grand Combin, W. of Corbassière Glacier.	12,212	3722
Petit Combin of Studer and V. de Bagnes .	N. W. of Petit Combin . . .	12,044	3671
44. Mont Pleureur . . .	Between Val de Bagnes and Val d'Hérémence.	12,159	3706
45. Tours des Courtes . .	S.E. of Aig. Verte, E. of Jardin .	12,119	3684
46. Aiguille de Blaitière . .	N.E. of Aig. du Midi . . .	12,097	3687
47. *Lo Besso . . .	S.S.E. of Zinal, W.N.W. of Rothhorn	12,057	3675
48. Aiguille de la Za . . .	Between Glaciers de Ferpécle and Arolla.	12,051	3673

Authority.	Method.	Remarks.
<i>Col de la Seigne to the Pass of the Gries</i> — continued.		
Forbes	Δ	"Travels in the Alps."
F.E.	Δ	Dufour's "Atlas der Schweiz" (Blatt 22).
Bravais and Martins .	Bar.	Durheim's "Hypsométrie."
F.E.	Δ	Bétemps.
"	Δ	Dufour's "Atlas der Schweiz" (Blatt 22).
De Saussure		Chaix, 12848, Bar. (Durheim and Ziegler).
F.E.	Δ	Bétemps.
"	Δ	Dufour's "Atlas der Schweiz" (Blatt 22).
Pictet	Bar.	Durheim's "Hypsométrie."
F.E.	Δ	Dufour's "Atlas der Schweiz" (Blatt 22).
"	Δ	Bétemps.
"	Δ	Dufour's "Atlas der Schweiz" (Blatt 22).
"	Δ	" " "
"	Δ	" " (Blatt 18).
"	Δ	" " (Blatt 22).
"	Δ	" " "
"	Δ	" " "
"	Δ	" " "
Forbes	Δ	"Travels in the Alps."
F.E.	Δ	Dufour's "Atlas der Schweiz" (Blatt 22).
"	Δ	" " " No name "
"	Δ	" " "
Forbes	Δ	"Travels in the Alps."
Malten	?	Durheim's "Hypsométrie."
F.E.	Δ	Dufour's "Atlas der Schweiz" (Blatt 22).
"	Δ	" " "

Name of Mountain.	Position.	Height in Eng. ft.	Height in mètres.
PENNINE ALPS (<i>from Col du Bonhomme and</i>			
49. Aiguille de Grepon . . .	N.N.E. of Aig. de Blaitière . . .	12,044	3671
50. Aiguille du Glacier . . .	S.W. of Mont Blanc, N. of Col de la Seigne.	12,011	3661
51. *Die Nase (highest point) . . .	S. of Lyskamm, dividing Lys Glacier	12,003	3658
52. *Monte Leone	E. of Simplon	11,696	3565
53. *Hoheslicht	W. of Lys Glacier, S.W. of Vincent Pyramide.	11,633	3546
54. Aiguille du Tour	Between Glaciers du Tour, de Trient, and d'Orny.	11,621	3542
55. *Mont Gelé	E. of Col de Fenêtre, S. of Otemma Glacier.	11,539	3517
56. Otemma (N.E. summit) . . .	Head of Val de Bagnes, N. of Otemma Glacier.	11,513	3509
57. *Mettelhorn	N. of Zermatt, W.S.W. of Täsch, E. of Rothhorn.	11,188	3410
58. Aiguille du Moine	S.S.W. of Aig. Verte, W. of Jardin .	11,109	3386
59. *Grauhaupt	Between Vals de Lys and d'Ayas, N.W. of Gressonay.	11,030	3362
60. *Mont Avril	N.W. of Col de Fenêtre, head of Val de Bagnes.	10,961	3341
61. Aiguille des Charmoz	E.N.E. of Aig. de Grepon	10,944	3336
62. Aiguille de Léchaud	N. of Petite Jorasse, between Glaciers de Léchaud and Talèfre.	10,914	3326
63. *Dent du Midi de Bex	S.W. of St. Maurice, S.E. of Champéry.	10,450	3185
64. Pointe de Salles	Between Sixt and Servoz, W. of Col d'Anterne.	10,433	3180
65. *Gornergrat	S.S.E. of Zermatt, W.N.W. of Monte Rosa.	10,290	3136
66. *Buet	N.E. of Chamouni, E.S.E. of Sixt .	10,207	3111
67. *Grands Mulets	N. of Mont Blanc, N.E. of Dome du Goûté.	10,013	3062
68. *Riffelhorn	S. of Zermatt, N. of Gorner Glacier .	9,616	2931
69. *Hörnli	E.N.E. of Matterhorn, S. of Zmutt Valley.	9,492	2893
70. *Cramont	S. of Mont Blanc and Allée Blanche, W. of Courmayeur.	9,059	2761
71. *Brevent	N.W. of Chamouni, N. of Mont Blanc.	8,330	2539

Authority.	Method.	Remarks.
<i>Col de la Seigne to the Pass of the Gries</i>)—continued.		
Malten	?	Durheim's "Hypsométrie."
Woerl	?	" "
Mean	Bar.	Zumstein, 12,097; Schlagintweit, 11,910.
F.E.	Δ	Dufour's "Atlas der Schweiz" (Blatt 18).
Zumstein	Bar.	Durheim's "Hypsométrie."
F.E.	Δ	Dufour's "Atlas der Schweiz" (Blatt 22).
"	Δ	Dufour's "Atlas der Schweiz" (Blatt 22). (Minimum Thermometer, No. 384.)
"	Δ	Dufour's "Atlas der Schweiz" (Blatt 22).
"	Δ	Bétemps. (Minimum Thermometer).
Forbes	Δ	"Travels in the Alps."
Zumstein	Bar.	Durheim's "Hypsométrie." Von Welden's "Der Monte Rosa." (Minimum Ther- mometer, No. 336).
F.E.	Δ	Dufour's "Atlas der Schweiz" (Blatt 22).
Forbes	Δ	"Travels in the Alps."
"	Δ	" "
F.E.	Δ	Dufour's "Atlas der Schweiz" (Blatt 17).
"	Δ	" " (Blatt 21).
"	Δ	Bétemps.
Favre	Bar.	Corabœuf, Δ 10,197; De Saussure, 10,105; De Candolle, 10,164.
Bravais and Martins. .	Bar.	Durheim's "Hypsométrie."
F. E.	Δ	Bétemps.
"	Δ	"
Mean	Bar.	Mean of Carrel, Favre, Forbes, and De Saussure (Durheim's "Hypsométrie").
"	Bar.	Mean of Pictet, Berger, De Saussure, Martins, and Chaix (Durheim's "Hyp- sométrie").

Name of Mountain.	Position.	Height in Eng. ft.	Height in mètres
BERNESE AND VALAISAN ALPS (<i>from</i>			
1. *Finsteraarhorn . . .	Between Finsteraar, Viescher, and Grindelwald Glaciers.	14,026	4275
Agassizhorn . . .	N.W. of Finsteraarhorn . . .	12,960	3950
Studerhorn . . .	E. of Finsteraarhorn . . .	11,916	3632
2. *Aletschhorn . . .	S.S.E. of Jungfrau, N.W. of Æg-gischhorn.	13,803	4207
3. *Jungfrau . . .	Head of Aletsch Glacier, S.E. of Lauterbrunnen.	13,671	4167
Kranzberg . . .	S.E. of Jungfrau . . .	12,198	3718
Silberhorn . . .	W.N.W. of Jungfrau . . .	12,106	3690
4. *Mönch . . .	N.E. of Jungfrau, E.S.E. of Wengern Alp.	13,438	4096
5. *Schreckhorn . . .	Between Lauteraar and Grindelwald Glaciers.	13,394	4082.5
*Lesser Schreckhorn (S.E. point).	S.E. of Schreckhorn . . .	13,173	4015
6. Viescherhörner (Walcherhörner).	W. of Finsteraarhorn, N. of Grünhorn Lücke.	13,281	4048
7. Gletscherhorn . . .	S. of Jungfrau, E. of Roththal .	13,064	3982
Ebneflüh . . .	W.S.W. of Gletscherhorn . . .	13,005	3964
Mittaghorn . . .	S.W. of Ebneflüh . . .	12,761	3889.5
Ahnengrat . . .	S.S.E. of Mittaghorn, N.W. of Löt-schenlücke.	12,076	3650.5
8. *Eiger . . .	N.E. of Mönch, W. of Grindelwald Glacier.	13,045	3976
9. *Nesthorn (Bietschhorn) .	E. of Kippel, N.N.W. of Visp .	12,969	3953
Breithorn . . .	N.E. of Nesthorn . . .	12,451	3795
10. Trugberg, N. point . . .	S.E. of Mönch . . .	12,903	3933
Middle point . . .	E. of Jungfrau, S.E. of Mönch .	12,008	3660
*S. point . . .	S.E. of Mönch, W. of Viescherhörner	11,526	3513
11. Viescherhörner (Walliser) .	Between Aletsch and Viesch Glaciers	12,812	3905
Wannehorn . . .	S.E. of Viescherhörner . . .	12,195	3717
12. Schienhorn, N. peak . . .	W.S.W. of Aletschhorn, S.S.W. of Löt-schenlücke.	12,638	3852
S. peak (Great Nesthorn)	S.S.W. of Schienhorn, W. of Jägi Glacier.	12,533	3820
13. Dreieckhorn . . .	N.E. of Aletschhorn . . .	12,540	3822
14. Breithorn . . .	E. of Tschingelhorn, N.W. of Löt-sch Glacier.	12,382	3774
15. Grosshorn . . .	E.N.E. of Breithorn, S. of Lauterbrunnen Thal.	12,346	3763

Authority.	Method.	Remarks.
<i>be Lake of Geneva to the Furka).</i>		
F. E.	Δ	Dufour's "Atlas der Schweiz" (Blatt 18). (Minimum Thermometer, No. 213.)
"	Δ	Dufour's "Atlas der Schweiz" (Blatt 18).
"	Δ	" " "
"	Δ	" " "
"	Δ	" " "
"	Δ	" " "
"	Δ	" " "
"	Δ	" " "
Eschmann	Δ	Ziegler's "Hypsométrie." Summit as- cended by Rev. L. Stephen.
"	Δ	Ziegler's "Hypsométrie." Summit as- cended by Desor?
F. E.	Δ	Dufour's "Atlas der Schweiz" (Blatt 18).
"	Δ	" " "
"	Δ	" " "
"	Δ	" " "
"	Δ	" " "
Eschmann	Δ	Durheim's "Hypsométrie." Tralles, 13,074.
F. E.	Δ	Dufour's "Atlas der Schweiz" (Blatt 18).
"	Δ	" " "
"	Δ	" " "
"	Δ	" " "
"	Δ	" " "
"	Δ	" " "
"	Δ	" " "
"	Δ	" " "
"	Δ	" " "
"	Δ	" " "
"	Δ	" " "
"	Δ	" " "

Name of Mountain.	Position.	Height in Eng. ft.	Height in mètres.
BERNESE AND VALAISAN ALPS (<i>from</i>			
16. *Wetterhörner (*Mittelhorn) *N. Peak (Wetterhorn or Hasle Jungfrau) *S. Peak (Rosenhorn)	S.E. of Scheidegg, N.E. of Schreckhorn.	12,166	3708.5
		12,149	3703
		12,107	3690
17. Balmhorn	S. of Gasteren Thal, E.S.E. of Altels.	12,100	3688
18. *Blumlis Alp	E. of Oeschinen Thal, N. of Tschingel Glacier.	12,041	3670
Middle Peak		12,011	3661
19. *Doldenhorn	S.W. of Blumlis Alp, N. of Gasteren Thal.	11,997	3656.5
20. *Oberaarhorn	E. of Finsteraarhorn, N. of Oberaarjoch.	11,923	3634
21. *Altels	S. of Gasteren Thal, E. of Schwarzenbach.	11,923	3634
22. Berglistock	S. of Wetterhörner, N. of Schreckhörner.	11,729	3575
23. *Lauteraarhörner	S.E. of Schreckhörner, N.W. of Abschwung.	11,401	3475
24. *Rinderhorn	S.W. of Altels, N.E. of Gemmi, N.N.E. of Leukerbad.	11,372	3466
25. *Wildhorn	N. of Sion, S.W. of Rawyl Pass, W.S.W. of Wildstrubel.	10,722	3268
26. *Wildstrubel	S. of Engstligen Thal, E.S.E. of Lenk.	10,716	3266
N.E. Peak		10,689	3258
S.W. Peak		10,653	3247
27. *Diablerets	S.S.W. of Gsteig, W.S.W. of Wildhorn.	10,666	3251
28. Wellhorn	N.E. of Wetterhörner, between Rosenlauri and Schwarzwald Glaciers.	10,486	3196
29. *Mettenberg	S.E. of Grindelwald, N. of Schreckhörner.	10,443	3183
30. *Löffelhorn	N. of Münster, S. of Oberaar Glacier.	10,138	3090
31. *Schilthorn	N. of Seftinen, W. of Lauterbrunnen, Thal.	9,728	2965
32. *Mainghorn (Torrenthorn) .	E. of Leukerbad, W.S.W. of Kippel.	9,679	2950
33. *Äggischhorn	N.W. of Viesch, S.E. of Aletsch Glacier.	9,649	2941
34. *Dent de Morcles	N. of Martigny, E.S.E. of St. Maurice.	9,639	2938
35. *Sidelhorn	S.W. of Grimsel, N.W. of Obergestelen.	9,449	2880
36. *Faulhorn	Between Grindelwald and the Lake of Brienz.	8,799	2682

the Lake of Geneva to the Furka)—continued.

Authority.	Method.	Remarks.
Denzler	Δ	Roth's "Gletscherfahrten in den Berner Alpen."
"	Δ	" .
"	Δ	"
F. E.	Δ	Dufour's "Atlas der Schweiz" (Blatt 17).
"	Δ	" (Blatt 18).
"	Δ	" "
"	Δ	" "
"	Δ	Dufour's "Atlas der Schweiz" (Blatt 18). (Minimum Thermometer.)
"	Δ	Dufour's "Atlas der Schweiz" (Blatt 17).
Mean	Δ	Frei, 11,723; Malten, 11,736 (Durheim's "Hypsométrie").
Stengel	Δ	Ziegler's "Hypsométrie."
F. E.	Δ	Dufour's "Atlas der Schweiz" (Blatt 17).
"	Δ	" "
"	Δ	" "
"	Δ	" "
"	Δ	" "
"	Δ	" "
Eschmann	Δ	Ziegler's "Hypsométrie." Durheim's "Hypsométrie."
Malten	?	" "
F. E.	Δ	Dufour's "Atlas der Schweiz" (Blatt 18).
"	Δ	" "
"	Δ	" (Blatt 17).
"	Δ	" (Blatt 18).
"	Δ	(Minimum Thermometer No. 312).
"	Δ	" (Blatt 17).
"	Δ	" (Blatt 18).
Mean	Δ and Bar.	Eschmann, 8806; Trechsel, 8826; Bravais and M. 8803; Kaemtz, 8767 (Durheim).

Name of Mountain.	Position.	Height in Eng. ft.	Height in mètres
ALPS OF UNTERWALDEN.			
1. *Galenstock . . .	Uri. N. of Furka and Rhone Glacier.	11,956	3644
2. *Tödi . . .	Glarus. S. of Linththal, N. of Vorder-Rhein Thal.	11,886	3623
3. *Sustenhorn . . .	Uri. S. of Susten Pass . . .	11,549	3520
4. *Piz Russein . . .	Glarus. S. of Tödi . . .	11,411	3478
5. Spitzliberg . . .	Uri. E. of Sustenhorn . . .	11,336	3455
6. Piz Urlaun . . .	Glarus. E. of Piz Russein . . .	11,063	3372
7. Oberalpstock(Piz Tgietschen)	Uri. E. of Bristenstock, S.E. of Maderaner Thal.	10,925	3330
8. Bifertenstock . . .	Glarus. E. of Tödi, N. of Trons . . .	10,778	3285
9. Claridenstock . . .	Uri. N.W. of Tödi, S. of Clausen Pass.	10,709	3264
10. *Titlis . . .	Unterwalden. S. of Engelberg Thal.	10,620	3237
11. *Grosse Windgelle . . .	Uri. N.E. of Amsteg . . .	10,463	3189
12. *Bristenstock . . .	Uri. S. of Amsteg . . .	10,089	3075
13. *Urirothstock . . .	Uri. N. of Isenthal, W. of Altorf . . .	9,621	2932.5
14. Glärnisch (Bächistock) . . .	Glarus. S. of Klönthal, S.W. of Glarus.	9,587	2922
Ruchi . . .	Glarus . . .	9,557	2913
GRISONS ALPS (<i>Lepontine Alps from the Simplon to</i>			
1. *Bernina . . .	S. of Pontresina, head of Mortiratsch Glacier.	13,294	4052
Piz Zupo (S.E. Peak) . . .	. . . . .	13,120	3999
Cresta Aguiza (Middle Peak).	. . . . .	12,702	3871.5
2. Piz Roseg (Monte Rosso di Scerscen).	W.S.W. of Bernina, head of Roseg and Tschierwa Glaciers.	12,936	3943
3. Piz Palü . . .	E. of Bernina, between Palü and Mortiratsch Glaciers.	12,835	3912
Piz Cambrena (E. Peak)	. . . . .	11,835	3607
4. Piz Mortiratsch . . .	N. of Bernina, between Tschierwa and Mortiratsch Glaciers.	12,316	3704
5. *Monte delle Disgrazie . . .	Valtelline, W. of Val Malenco . . .	12,008	3660
6. Pizzo di Verona . . .	W.N.W. of Poschiavo, S.E. of Piz Palü, and S. of Palü Glacier.	11,358	3462

Authority.	Method.	Remarks.
URI, AND GLARUS.		
Mean	Bar.	Berchthold, 11,801; Von Welden, 12,074; Müller, 11,988 (Durheim's "Hypsométrie").
F. E.	Δ	Dufour's "Atlas der Schweiz" (Blatt 14).
Mean	Δ and Bar.	Eschmann, 11,529; Müller, 11,575; Von Welden, 11,624; Frei, 11,467 (Durheim).
F. E.	Δ	Dufour's "Atlas der Schweiz" (Blatt 14).
Müller	Bar.	Durheim's "Hypsométrie."
F. E.	Δ	Dufour's "Atlas der Schweiz" (Blatt 14).
"	Δ	" "
"	Δ	" "
"	Δ	" "
Eschmann . . .	Δ	Ziegler's "Hypsométrie." Durheim's "Hypsométrie."
F. E.	Δ	Dufour's "Atlas der Schweiz" (Blatt 14).
"	Δ	" "
Eschmann . . .	Δ	Ziegler's "Hypsométrie."
F. E.	Δ	Dufour's "Atlas der Schweiz" (Blatt 14).
"	Δ	" (Blatt 9).

the Bernhardin—Rhetian Alps from Bernhardin to the Stelvio).

F. E.	Δ	Dufour's "Atlas der Schweiz" (Blatt 20).
"	Δ	" " "
"	Δ	" " "
"	Δ	" " "
"	Δ	" " "
"	Δ	" " "
"	Δ	" " "
Mean	Δ and Bar.	F. E. 12,074; Dufour's "Atlas der Schweiz" (Blatt 10); Austrian Engineers, 12,057; Salis Marschlins (Ziegler), 11,893, Bar.
F. E.	Δ	Dufour's "Atlas der Schweiz" (Blatt 20).

Name of Mountain.	Position.	Height in Eng. ft.	Height in mètres.
GRISONS ALPS (<i>Lepontine Alps from the Simplon to</i>			
7. Piz Corvatsch . . .	S.S.E. of Silvaplana, N.W. of Roseg Glacier.	11,345	3458
8. Piz Tremoggia . . .	W.S.W. of Piz Roseg, N. of Val Malenco.	11,326	3452
9. *Piz Linard . . .	N. of Sus and N.W. of Lavin (Engadine).	11,208	3416
10. Cima del Largo . . .	N. of Val Mello, between Albignio and Forno Glaciers.	11,162	3402
11. Rheinwaldhorn (Piz Val-rhein).	Head of Rheinwald and W. of Zapport Glaciers.	11,148	3398
12. Jopperhorn (Punta Platta)	N. and N.E. of Avers Thal . . .	11,109	3386
13. Punta Trubinesca . . .	S. E. of Bondo, Val Bregaglia . . .	11,106	3385
14. Cima di Rosso . . .	W. of Val Malenco, S.S.E. of Forno Glacier.	11,024	3360
15. *Piz Languard . . .	E. of Pontresina	10,715	3265
16. Ringelkopf (Ringelspitz) .	N. of Trins, S. of Calfeuserthal . .	10,519	3207
TYROLESE ALPS, &c. (<i>from</i>			
1. ? Orteles (Monte Cristallo)	S.E. of Stelvio Pass, E.N.E. of Bormio	? 12,960	? 3950
*Orteler Spitze . . .	E. of Monte Cristallo	12,832	3911
Zebbru (Königs Spitze) .	E.S.E. of Monte Cristallo	12,692	3868.5
2. *Gross Glockner . . .	S. of Pinzgau, N.W. of Heiligenblut.	12,958	3949.5
3. Weiss Kugel . . .	Oetz Thal, S.W. of Langtaufner Joch	12,620	3846.5
4. *Wildspitz (W. Peak) . .	N.W. of Vent or Fend	12,359	3767
5. Firmian Spitze . . .	Head of Gurgl and Nieder Thals, N. of Similaun.	12,214	3723
6. *Gross Venediger . . .	Head of Sulzbach Thal (Pinzgau), W. of Gross Glockner.	12,056	3674.5
7. Weissbachhorn . . .	N.E. of Gross Glockner, head of Fuscher Thal.	12,044	? 3671
8. *Similaun . . .	Oetz Thal, S.S.W. of Vent, S.E. of Niederjoch.	11,859	3614.5
9. *Marmolata . . .	Head of Vals Fassa and Agordo, S.E. of Fena.	? 11,749	? 3581
10. Adamello . . .	E. of Edölo (Val Camonica), between Tyrol and Valtelline.	11,670	3557
11. Hohe Fürst Kugel . . .	S.E. of Ober-Gurgl, Oetz Thal . .	11,463	3494

Authority.	Method.	Remarks.
<i>Bernhardin--Rhatian Alps from Bernhardin to the Stelvio</i> —continued.		
E.	Δ	Dufour's "Atlas der Schweiz" (Blatt 20).
"	Δ	" " "
"	Δ	" " "
"	Δ	" " "
"	Δ	" " (Blatt 19).
"	Δ	" " (Blatt 20).
"	Δ	" " "
"	Δ	" " "
"	Δ	" " "
"	Δ	" " (Blatt 14).
<i>the Stelvio to Rauriser Tauern</i>).		
Austrian Engineers . . .	Δ	Ziegler's "Hypsométrie."
Mean	Δ	Von Welden, 12,851; Austrian Engineers, 12,812 (Ziegler's "Hypsométrie").
Austrian Engineers . . .	Δ	Von Welden ("Der Monte Rosa"); Ziegler's "Hypsométrie," 12,271; Mayr, 12,165.
Schlagintweit	Bar.	Schlagintweits' "Untersuchungen."
Fallon	Δ	" " Baumgartner.
Austrian Engineers . . .	Δ	"Untersuchungen." The Schlagintweits made the E. peak 12,244 (Bar. &c.)
Mayr	?	"Karte vom Lande Tyrol."
Austrian Engineers . . .	Δ	" "
Von Welden		"Der Monte Rosa." Mayr ("Karte vom Lande Tyrol") gives 11,468.
Mean	Δ and Bar.	Schlagintweits' "Untersuchungen," 11,867; Austrian Engineers, 11,851.
Austrian Engineers . . .	Δ	Too high by 500 feet probably. Mayr gives 11,084 ("Karte vom Lande Tyrol").
Von Welden	Δ	"Der Monte Rosa." Mayr gives a second summit to the W. as 11,948 ("Karte vom Lande Tyrol").
Austrian Engineers . . .	Δ	Mayr gives 11,122 ("Karte vom Lande Tyrol").

TABLE OF ALPINE PEAKS.

Name of Mountain.	Position.	Height in Eng. ft.	Height in metres.
TYROLESE ALPS, &c. (<i>from the</i>			
12. Glockthurm	W. of Gebatsch Alp, N.E. of Lang- taufere Thal.	11,274	3436
13. Löffel (Trippach Spitze) .	N. of Taufers, S. of Ziller Thal .	11,188	3410
14. *Rachern . . . . .	. . . . .	11,045	3366.5
15. Habicht Spitze . . . .	. . . . .	11,031	3362
MISCEL-			
1. Monte Tresero	Valtelline. S.E. of Bormio, head of Val Furva.	11,869	3617
2. Monte Confinale	Valtelline. S. of Ortles, N. of Val Furva.	11,076	3376
3. Cavigno (Basodine) . . .	Tessin. Heads of Vals Formazza and Bavone.	10,748	3276
4. Antelao	Venetian Alps. S. of Lessach Thal	10,680	3255
5. *Pelmo	" " "	10,565	3220
6. *Terglon	Carniola (Julian Alps)	9,377	2858
7. *Paralba	Friul	8,747	2666

Authority.	Method.	Remarks.
<i>Stelvio to Rauriser Tauern</i>)—continued.		
Mayr	?	"Karte vom Lande Tyrol."
Austrian Engineers	Δ	Mayr gives 11,084 ("Karte vom Lande Tyrol").
Schlagintweits	Bar.	"Untersuchungen."
Austrian Engineers	Δ	
LANEOUS.		
Von Welden	Δ	"Der Monte Rosa."
"	Δ	" "
F. E.	Δ	Dufour's "Atlas der Schweiz" (Blatt 18).
Estimate		
Mayr		
Estimate		Baumgartner, 9344. See Schlagintweits' "Untersuchungen," and Mayr's map.
Schaubach		

3. TABLE OF

exceeding 9000 English

Name of Col.	Between or near to what Peaks.	Where from and to.
MARITIME ALPS (<i>Mediterranean</i>)		
1. Col de Maurin . . .	N. of Rioburent . . .	Maurin to Maira . . .
COTTIAN ALPS (<i>Monte Viso to the Levanna</i>)		
1. Col d'Arnaz . . .	S. of Levanna . . .	Bessans to Lanzo . . .
2. Col de Galambre . .	S.W. of Mont d'Ambin. .	Bramans to Exilles . .
3. Col de Traversette .	N. of Monte Viso . . .	Abriès to Crissolo . . .
4. Col de Vallante . . .	W. of Monte Viso . . .	Abriès to Château Dauphin .
5. Col de Seylières . .	N. of Monte Viso . . .	La Ruine to Bobbio . . .
6. Col d'Étiaches . . .	S.W. of Mont d'Ambin .	Bramans to Rochemolle . .
7. Col de la Rella . . .	. . . . .	Near Mont Cénis . . .
8. Col de Galibier . . .	. . . . .	Lautaret to Val de Valloire .
DAUPHINÉ ALPS (<i>from Pic du Frêne southwards</i>)		
1. Col de Sais . . .	. . . . .	La Bérarde to Val Godemar .
.
2. Col de la Tempe . .	Grand Pelvoux Pointe des Verges.	La Bérarde to L'Alfred . .
(Col de la Bérarde?).		
3. Col de Souffle . . .	. . . . .	. . . . .
4. Col de Célar . . . .	. . . . .	Val Godemar to Val Louise .
5. Col des Infernets .	. . . . .	La Grave to St. Jean de Maurienne.
6. Col de Chabrières .	. . . . .	Vallon de Réalon to Chorges .
7. Col d'Arsines . . . .	. . . . .	Villard d'Arène to Monétier .

ALPINE PASSES

feet (2743 mètres) in height.

Height in Eng. ft.	Height in mètres.	Authority.	Method.	Remarks.
<i>to S. base of Monte Viso).</i>				
9,784	2982	Bruguière .		"Le Alpi che cingono l' Italia."
<i>inclusive, and westwards as far as Mont Tabor).</i>				
10,233	3119	Francesetti .		"Lettres sur les Vallées de Lanzo."
10,200	3109	E. M. P. i. e. État- Major Pié- montais.	Bar.	"Le Alpi."
9,826	2995	E. M. P. .	Δ	"Le Alpi." Forbes makes it 9992 (Bar.). VonWelden ("DerMonte Rosa") gives 9963 (Bar.). Schuckburgh (Phil. Trans.) 9997.
9,365	2854.5	Mathews .	Bar.	Forbes makes it 9330 (Bar.).
9,247	2818	"	"	
9,301	2835	E. M. P. .	Δ	"Le Alpi."
9,187	2800	Brousseau .	Bar.	Durheim's "Hypsométrie."
9,154	2790	Janson. Chaix .	"	"Le Alpi." Durheim's "Hypsométrie."
<i>W. of the Arc, Val de Valloire, and the Durance).</i>				
11,017	3358	Baron Zach .		"Le Alpi."
10,224	3116	Forbes .	Bar.	"Excursions in Dauphiné."
? 10,889	? 3319	Berghaus .		"Le Alpi." Doubtful.
? 10,384	? 3165	Héric. de Thury		"Le Alpi." Doubtful.
10,073	3070	Forbes .	Bar.	"Excursions in Dauphiné."
10,000	? 3048	"	Estimate	" "
9,692	2954	Guérin .		"Le Alpi."
9,357	2852	Baron Zach .		"

Name of Col.	Between or near to what Peaks.	Where from and to.
GRAIAN ALPS (<i>Levanna to Col de la Seigne, N. of</i>		
1. Col de la Grivola .	S. of La Grivola	Valsavaranche to Cogne . .
2. Col de Gailletta (Goletta.)	S. of Aig. de la Sassiére.	Tignes to Villeneuve . .
3. Col de Galèse . .	. . . . .	Tignes to Cérésol
4. Col d'Arietta (La Nova).	. . . . .	Cogne to Val Soana
5. Col de Rosoire, Rosué, or d'Aus- sois.	W. of Roche Chévière.	Pralognan to Aussois . . .
6. Col d'Arbole . . .	W. of Mont Emilius . . .	Aosta to Cogne
7. Col des Encombres	E. of Perron des Encombres	St. Michel (Maurienne), Mou- tiers (Tarentaise)
8. Col d'Iséran . . .	. . . . .	Tignes to Bonneval
.
9. Col de la Leisse . .	E. of La Grande Motte . .	Tignes to Entre-deux-Eaux .
10. Col de Chavière . .	W. of Pointe de Massa . .	Pralognan to Modane . . .
PENNINE ALPS (<i>from Col du Bonhomme</i>		
1. Lys Joch (Silber Pass).	Monte Rosa and Lyskamm .	Zermatt to Gressonay . . .
2. Zwillinge Joch (Col des Ju- meaux)	Lyskamm and Les Jumeaux .	„ „
3. Schwarz Thor . . .	Les Jumeaux and Breithorn .	Zermatt to S. Giacomo d'Ayas
4. Alphubel Joch . . .	Alphubel and Allelinhorn .	Saas or Fée to Zermatt or Täsch
5. Col d'Argentiére . .	Aiguilles Rouges and Mont Dolent	Argentiére to Val Ferret and Orsières
6. Adler Joch	Strahlhorn and Rympfischhorn	Zermatt to Mattmark and Saas
7. Old Weiss Thor (Head of Jazi Gl.)	Monte Rosa and Cima di Jazi	Zermatt to Macugnaga . . .
8. Old Weiss Thor (Head of Filar Gl.)	„ „	„ „
9. New Weiss Thor . .	Cima di Jazi and Strahlhorn	„ „ . . . or Saas
10. Col de la Valpel- line	S. of Tête Blanche	Zermatt to Prerayen and Aosta

Height in Eng. ft.	Height in mètres.	Authority.	Method.	Remarks.
<i>the Arc and Val di Locana, and S. of Val d'Aoste).</i>				
12,250	3734	Tuckett . . .	Bar.	
10,149	3093.5	Mathews . . .	"	
? 10,000?	3048	Murray's Hand- book		Doubtful. Probably not far from the truth.
9,656	2943	Favre . . .	Bar.	Durheim's "Hypsométrie."
9,628	2934.5	Mathews . . .	"	
9,341	2847	Favre . . .	"	Durheim's "Hypsométrie."
9,205	2805.5	Von Welden . .	Δ & Bar.	" "
9,196	2803	E. M. P. . .	Δ	"Le Alpi," &c. Durheim's "Hypsomé- trie."
9,154	2790	Schlagintweit . .	Bar.	"Neue Untersuchungen."
9,168	2794.5	E. M. P. . .	Δ	"Le Alpi," &c. Mathews, 9068 (Bar.)
9,144	2786	Mathews . . .	Bar.	
<i>and Col de la Seigne to Pass of the Gries).</i>				
14,040	4279.5	Tuckett . . .	Bar. & B. P.	Barometer, 14,053; boiling-point Thermo- meters, 14,028 (mean of 2). Zumstein (Von Welden) made the plateau 14,100.
13,517	4120	" . . .	"	Geneva, 13,580; Aosta, 13,577; St. Ber- nard, 13,393; mean, 13,517.
12,777	3894.5	Buxton . . .	B. P.	Boiling-point Thermometer.
12,575	3833	Tuckett . . .	"	Kolb's aneroid, 12,663.
12,556	3827	" . . .	Bar.	Mean of 4 Barometer Observations. (Mi- nimum Thermometer, No. 314.)
12,461	3798	F. E. i.e. Federal Engineers	Δ	Bétemps.
11,976	3650	Tuckett . . .	Bar.	
11,801	3597	F. E. and Schlagintweit	Δ & Bar.	F. E. 11,733; Schlagintweit, 11,870; Mean, 11,801.
11,851	3612	F. E. . . .	Δ	Bétemps.
11,687	3562	Buxton . . .	B. P.	11,750 probable height.

Name of Col.	Between or near to what Peaks.	Where from and to.
<i>PENNINE ALPS (from Col du Bonhomme)</i>		
11. Allelin Pass (Täsch Joch)	Allelinhorn and Rympfischhorn	Zermatt or Täsch to Mattmark or Saas
12. Trift Joch (Col de Zinal)	Trifthorn and Ober-Gabelhorn	Zermatt to Zinal . . .
13. Col de Sonadon .	S. of Grand Combin (Graffenneire)	St. Pierre d'Entremont to Chermontane
14. Eringer Joch (Col de Ferpêche)	Dent Blanche and Tête Blanche	Zermatt to Evolena . . .
15. Col de la Dent Blanche (Durand)	Dent Blanche and Ober-Gabelhorn	Zermatt to Zinal . . .
16. Col de Salena .	N.E. of La Grande Fourche, S. of Aig. du Tour	Chamouni or Village du Tour to Orsières
17. Col des Bouquetins	Tête Blanche and Dents de Bertol	Prerayen (Valpelline) to Evolena
18. Col du Tour . .	S. of Aiguille du Tour . .	Village du Tour to Orsières .
19. Col de la Maison Blanche	W. of Grand Combin . .	St. Pierre d'Entremont to Val de Bagnes, <i>viâ</i> Corbassière Glacier
20. Col du Géant . .	S.W. of Aiguille du Géant .	Chamouni to Courmayeur .
21. Col de Boveire .	S.S.W. of Petit Combin . .	Allèves (Val d'Entremont) to Gl. de Corbassière
22. Col de Miage . .	Aiguilles de Miage and de Bionnassay	St. Gervais to Courmayeur .
23. Col du Mont Rouge	Mont Blanc de Cheillon and Mont Pleureur	Chermontane to Evolena. .
24. Col de Ried . .	Ulrichshorn and Balferinhorn	Saas to St. Niklaus . . .
25. Col de St. Théodule	Matterhorn and Petit Mont Cervin	Zermatt to Châtillon . . .
26. Zwischbergen Joch	Weissmies and Portiengrat .	Saas to Gondo
27. Col de la Reuse de l'Arolla	S.W. of Mont Collon . . .	Prerayen to Chermontane .
28. Col delle Piscie .	Vincent Pyramide and Corno del Camozzo	Embours Thal to Lavez Thal .
29. Col de Collon . .	S. of Mont Collon. . . .	Evolena to Prerayen and Aosta
30. Col de Chermontane	Pigne d'Arolla and Mont Collon	Chermontane to Evolena
31. Col des Cimes Blanches	Petit Mont Cervin and Cimes Blanches	St. Giacomo d'Ayas to Breuil
32. Pas de Forcletta .	N. of Diablons	Ayer to Turtmann Thal. .
33. Col de Torrent . .	S. of Sasseneire	Evolena to Vals Torrent and Anniviers
34. Col de Bréona . .	N. of Zatalani	Evolena to Vals Torrent and Anniviers

Height in Eng. ft.	Height in metres.	Authority.	Method.	Remarks.
<i>and Col de la Seigne to Pass of the Gries</i>)—continued.				
11,654	3552	Michaëlis . .		Quoted by Schlagintweit.
11,614	3540	F. E. . .	Δ	Dufour's "Atlas der Schweiz" (Blatt 22). (Minimum Thermometer, No. 333.)
? 11,483	3500	" . .	Δ	Dufour's "Atlas der Schweiz" (Blatt 22).
11,418	3480	" . .	Δ	Dufour's "Atlas der Schweiz" (Blatt 22). (Minimum Thermometer, No. 313.)
11,398	3474	" . .	Δ	Dufour's "Atlas der Schweiz" (Blatt 22).
11,309	3447	Forbes . .	Bar.	"Travels in Norway," appendix. Above actual Col.
11,214	3418	F. E. . .	Δ	Dufour's "Atlas der Schweiz" (Blatt 22).
11,213	3417·6	Tuckett . .	Bar.	
11,212	3417·5	Mathews . .	"	
11,197	3413	Mean . .	"	De Saussure, 11,247; Forbes, 11,146.
? 11,100	3383	Estimate . .		Mathews and Jacomb. "Nearly as high as Col de la Maison Blanche"?
11,100	3383	Hudson and Tuckett	"	Aneroid (by Lerebours-Secretan, Paris).
10,958	3340	F. E. . .	Δ	Dufour's "Atlas der Schweiz" (Blatt 22).
?	?			
10,899	3322	" . .	Δ	Bétemps. Mean of Studer, Carrel, and De Luc, 10,948; Mathews, 10,941.
10,742	3274	" . .	Δ	Bétemps.
10,506	3200·5	Tuckett . .	Symp.	Sympiesometer (Casella).
10,374	3162	Schlagintweit .	Bar.	"Neue Untersuchungen."
10,268	3130	F. E. . .	Δ	Dufour's "Atlas der Schweiz" (Blatt 22).
10,118	3084	" . .	Δ	Dufour's "Atlas der Schweiz" (Blatt 22). Buxton, 10,349, Boiling-point Thermo- meter. (Minimum Thermometer.)
9,912	3021	De Saussure .	Bar.	"Voyages."
9,816	2990	F. E. . .	Δ	Dufour's "Atlas der Schweiz" (Blatt 17).
9,593	2924	" . .	Δ	Dufour's "Atlas der Schweiz" (Blatt 22). Studer in Durheim, 9695.
9,574	2918	" . .	Δ	Dufour's "Atlas der Schweiz" (Blatt 22). Favre in Durheim, 9688.

Name of Col.	Between or near to what Peaks.	Where from and to.
PENNINE ALPS (<i>from Col du Bonhomme</i>)		
35. Col d'Ollen . . .	S. of Mont Ollen and Col delle Piscie	Alagna to Gressonay la Trinité
36. Col de la Crête Sèche	Mont Gelé and Trouma de Boues	Chermontane to Biona (Valpelline)
37. Monte Moro . . .	Faderhörner and St. Joderhorn	Saas to Macugnaga . . .
38. Col de Riedmatten	S. of Mont Rouge, N.W. of Pigne d'Arolla	Evolena to Hérémence Thal .
39. Antrona Pass (Furgthal)	Latelhorn and Jazhorn . . .	Saas to Val Antrona . . .
40. Col de Sorebois . .	S. of Corne de Sorebois. . .	Zinal to Val Torrent . . .
41. Col de Trelatête . .	Aiguille du Glacier and Tandiou or Tondou	St. Gervais or Contamines to Col de la Seigne . . .
42. Pas du Bœuf . . .	S. of Borterhorn	Vissoye or St. Luc to Turtmann Thal
43. Col de Fenêtre de Chermontane	Mont Gelé and Mont Avril .	Chermontane to Valpelline and Aosta
44. Col Turlo	Monte Turlo and Cima di Rima	Macugnaga to Alagna . . .
BERNESE ALPS (<i>from</i>)		
1. Lauwinen Thor . . .	Jungfrau and Gletscherhorn	Lauterbrunnen to Aletsch Gl.
2. Eiger Joch	Eiger and Mönch	Lauterbrunnen or Grindelwald to Aletsch Glacier.
3. Mönch Joch	Mönch and Viescherhörner (Walcherhörner).	Grindelwald to Aletsch Glacier.
4. Strahleck	S. of Schreckhörner	Grindelwald to Grimsel . .
5. Lauteraar Joch . . .	Schreckhörner and Wetterhörner.	Grindelwald to Grimsel . .
6. Rothsattel (1) . . .	Rothhorn and Finsteraarhorn.	Oberraarjoch to Névê of Viescher Glacier.
7. Rothsattel (2) . . .	Finsteraarhorn and Oberraarhorn.	Viescher Glacier to Finsteraar Glacier.
8. Grünhorn Lücke . .	Walcherhörner and Walliser Viescherhörner.	Aletsch Glacier to Viescher Glacier.
9. Gault Pass	E. of Ewigschneeorn	Unteraar Glacier to Urbach Thal.
10. Oberraar Joch . . .	Oberraarhorn and Rothhorn .	Grimsel to Viesch or Æggischhorn.
11. Petersgrat	W. of Tschingelhorn	Tschingel Glacier to Lötsch Thal.

Height in Eng. ft.	Height in mètres.	Authority.	Method.	Remarks.
<i>and Col de la Seigne to Pass of the Gries</i> —continued.				
9,544	2909	Schlagintweit .	Bar.	"Neue Untersuchungen."
9,475	2888	F. E. . .	Δ	Dufour's "Atlas der Schweiz" (Blatt 22).
9,390	2862	" . .	Δ	Bétemps.
9,354	2851	" . .	Δ	Dufour's "Atlas der Schweiz" (Blatt 22).
9,331	2844	" . .	Δ	9643, Favre in Durheim. Bétemps.
9,257	2821.5	Plantamour .	Bar.	"Observations Hypsométriques."
9,204	2805.5	Tuckett . .	Symp.	Mean of 2 observations.
9,154	2790	F. E. . .	Δ	Ziegler's "Hypsométrie."
9,141	2786	" . .	Δ	Dufour's "Atlas der Schweiz" (Blatt 22).
9,088	2770	Schlagintweit .	Bar.	"Neue Untersuchungen."

Lake of Geneva to the Furka).

? 12,415	? 3784	F. E. = Federal Engineers.	Δ	Dufour's "Atlas der Schweiz" (Blatt 18). It is doubtful whether the figures in Dufour refer to the exact points at which the passages have been made.
? 12,294	? 3747	" . .	Δ	Dufour's "Atlas der Schweiz" (Blatt 18).
? 11,680	? 3560	" . .	Δ	" " "
11,060	3371	Agassiz & Desor	Bar.	Ziegler's "Hypsométrie." 11,002, Tuckett (Bar.).
? 11,000	? 3353			I can get no information as to the height.
10,925	3330	Schlagintweit .	Bar.	"Neue Untersuchungen."
10,906	3324	Hugi . .	Bar.	Durheim's "Hypsométrie."
10,843	3305	F. E. . .	Δ	Dufour's "Atlas der Schweiz" (Blatt 18).
10,743	3274.5	Schlagintweit .	Bar.	"Neue Untersuchungen."
10,624	3238	F. E. . .	Δ	Dufour's "Atlas der Schweiz" (Blatt 18).
? 10,555	? 3217	" . .	Δ	Dufour's "Atlas der Schweiz" (Blatt 18). A snow-ridge or "grat" rather than a true Col.

Name of Col.	Between what Peaks.	Where from and to.
BERNESE ALPS (<i>from Lake</i>		
12. Lötschsattel .	Aletschhorn and Ahnengrat	Aletsch Glacier to Lötsch Thal
13. Schneitschnur Pass	S. and S.E. of Balmhorn .	Leukerbad to Lötsch Thal .
14. Gämchi Lücke .	Blümlis Alp and Gspaltenhorn.	Tschingel Glacier to Kien Thal
15. Tschingel Joch .	Tschingelhorn and Gspaltenhorn.	Lauterbrunnen to Kandersteg
ALPS OF GLARUS		
1. Sandgrat .	Tödi and Catscharauls .	Linth Thal to Dissentis (Rhein Thal).
2. Grassen Pass .	E. of Titlis	Engelberg to Maienthal .
3. Kisten Pass .	N.E. of Kistenhorn . .	Linth Thal to Brigels (Rhein Thal).
GRISONS ALPS (<i>Lepontine and Rhatian Alps. From</i>		
1. Fex Pass . . .	W. of Piz Tremoggia . .	Oberengadin to Malenco .
2. Samnaun or Salet Pass.	Between Mondiner & Muttler	Val Samnaun to Remus (Engadine).
3. Passo di Val Sterla		Avers to Cleven (Chiavenna).
4. Col d'Avers .		Avers to Septimer Pass . .
5. Aeschia Pass .	S. of Piz Kesch	Madulein (Engadine) to Val Tour.
6. Kanalluckli (Plattinschlucht ?).	Kanal Glacier and Zapport Glacier.	St. Peter (Valserthal) to Hinterrhein.
7. Lavirum (Levaroue) Pass.	N. of Piz Lavirum . . .	Campovasto (Engadine) to Val Federa.
8. Fermont Pass .	N.E. of Piz Buin	Guarda (Engadine) to Ochsen-thal (Vorarlberg).
9. Piller Pass . .	N. of Piz Linard, S. of Schwarzhorn.	Klosters (Prättigau) to Lavin (Engadine).
10. Plattenberg Pass .		Vals to Olivone
11. Futschöl Pass .	E. of Augsten Berg . . .	Val Tasna (Engadine) to Jamthal (Vorarlberg).
12. Sertig Pass . .	S.W. of Kühalp	Davos am Platz to Scans (Engadine).
13. Fuorela . . .	N.N.E. of Piz Corvatsch .	Silvaplana to Val Roseg .
14. Passo di Sacco .	N. of Punta di Teo . . .	Val Campo to Val Sacco .
TYROLESE		
1. Stilfser Joch (Stelvio)	N.W. of Orteler	Bormio (Valtelline) to Mals (Tyrol).
2. Scaradra Pass .		Val Blenio (Tessin) . . .

Height in Eng. ft.	Height in mètres.	Authority.	Method.	Remarks.
<i>of Geneva to the Furka</i> —continued.				
10,512	3204	F. E. . .	Δ	Dufour's "Atlas der Schweiz" (Blatt 18).
9,413	2869	B. Studer . .	Bar.	Durheim's Hypsométrie."
9,272	2826	F. E. . .	Δ	Dufour's "Atlas der Schweiz" (Blatt 18).
9,252	2820	" . .	Δ	"

AND UNTERWALDEN.

9,209	2807	F. E. . .	Δ	Dufour's "Atlas der Schweiz" (Blatt 14).
9,141	2786	Escher v. d. Linth	Bar.	Ziegler's "Hypsométrie."
79,059?	2761	Mean of several (Durheim).;		F. E. (Dufour's "Atlas der Schweiz," Blatt 18) give 8498.

the Simplon to Bernhardin, and thence to the Stelvio.

9,912	3021	Coaz . .	Δ	"Geographische Mittheilungen." 1862, Heft I. S. 10. Dufour's "Atlas" (Bl. 20).
9,565	2915	Mean . .	Δ & Bar.	Heer, 9452 (Durheim's "Hypsométrie"); Coaz, 9679 ("Geog. Mitt." 1862.)
9,515	2900	Coaz . .	Δ	"Geographische Mittheilungen," 1862. Dufour's "Atlas" (Blatt 19—20).
9,393	2863	C. Escher . .	Bar.	Durheim's "Hypsométrie."
9,347	2849	B. Studer . .	Bar.	Ziegler's "Hypsométrie."
9,314	2839	F. E. . .	Δ	Dufour's "Atlas" (Blatt 19). Heer (in Durheim), 9347.
9,249	2819	" . .	Δ	Dufour's "Atlas" (Blatt 15). 9442, Heer (in Durheim).
9,206	2806	" . .	Δ	Dufour's "Atlas" (Blatt 15).
9,131	2783	" . .	Δ	"
9,088	2770	Coaz . .	Δ	"Geographische Mittheilungen," 1862. Dufour's "Atlas" (Blatt 19).
9,078	2767	" . .	Δ	Dufour's "Atlas" (Blatt 15).
9,062	2762	" . .	Δ	"
9,042	2756	Coaz . .	Δ	"Geographische Mittheilungen," 1862. Dufour's "Atlas" (Blatt 20).
9,026	2751	" . .	Δ	Dufour's "Atlas" (Blatt 20).

ALPS, &c.

9,177	2797	Austrian Engi- neers (Von Welden).	Δ	Durheim's "Hypsométrie."
9,116	2778.5	Mean of Heer and Escher.	Bar.	Durheim's "Hypsométrie."

4. THE PYRENEES FROM W. TO E.

*Comprising the Peaks above 9000 feet, and Passes above 8000 feet of elevation.**

Latitude N.	Longitude W. of Greenwich.	Peak or Pass.	Mètres.	Fect.	Where situate.
42° 57' 0"	0° 7' 0"	Pic de Penamarela, S.	?2880	9,450	Asturias
42° 41' 0"	0° 24' 0"	Peña Colorada, S.	2800	9,186	
42° 52' 0"	0° 27' 0"	Pic du Midi d'Ossau, F.	2985	9,793	(Lezat, Reboul et Vidal. Others give 2885 mètres.)
42° 45' 0"	0° 28' 0"	Port d'Izas, S.	2817	9,162	From Sallent to San Antoine.
42° 53' 0"	0° 20' 0"	Arrieu Grand, F.	2976	9,764	
42° 50' 0"	0° 23' 0"	Som de Scoubé	2825	9,269	
42° 48' 0"	0° 19' 20"	Port de Lavedan	?2835	?9,300	From Val d'Azun to Sallent.
42° 48' 0"	0° 18' 30"	Baletons or Marmuret	3145	10,318	
42° 54' 0"	0° 15' 0"	Pic Cristail, F.	2992	9,817	
42° 48' 0"	0° 15' 0"	Pène d'Arragon	2865	9,399	
42° 48' 0"	0° 14' 0"	Port de Fonfry	?2630	8,624	Val de Labat to Panticosa.
42° 48' 0"	0° 11' 0"	Pic Peterneille	3020	9,909	
42° 47' 0"	0° 9' 0"	Col d'Aratille	?2750	9,023	Lac de Gaube to Val de Serbigliana.
42° 46' 0"	0° 8' 30"	Vignemale	3298	10,820	
42° 48' 0"	0° 7' 0"	Col de Vignemale, F.	2788	9,148	C. P. Lac de Gaube to Val d'Ossoue: Gavarnie.
42° 49' 0"	0° 5' 0"	Col de Lac d'Estom, F.	?2800	9,187	C. P. Cauterets to Val d'Ossoue.
42° 50' 0"	0° 2' 0"	Pic d'Ardidieu, F.	2988	9,803	
42° 49' 30"	0° 0' 40"	Pic Aubiste, F.	2791	9,157	
42° 47' 30"	0° 0' 40"	Pic Malle Rouge, F.	2969	9,715	
42° 43' 20"	0° 2' 0"	Les Tourettes	3033	9,921	
42° 43' 0"	0° 1' 30"	Le Taillon	3146	10,322	
42° 43' 0"	0° 0' 0"	Brèche de Roland	2804	9,200	
42° 42' 0"	Long. E. 0° 0' 30"	Casque de Marboré	3006	9,860	

* The peaks and passes followed by the letter S are on the Spanish side, and those followed by F on the French side of the frontier. Those not so designated are on the frontier line.

Latitude N.	Longitude E. of Greenwich.	Peak or Pass.	Mètres.	Feet.	Where situate.
42 42 0	0 1 0	Tour de Marboré .	3018	9,908	
42 43 0	0 2 30	Pic Astazou, F. .	3080	10,105	
42 43 0	0 2 30	Pic de Cascade .	3037	9,951	
42 42 0	0 2 0	Cylindre, S. .	3322	10,899	
42 41 0	0 3 0	Mont Perdu, S. .	3351	10,994	
42 45 0	0 1 30	Piméné .	2804	9,200	
42 43 0	0 4 30	Sœurs de Trumouse	3086	10,125	
42 43 0	0 3 0	Port de Canaou .	? 2771	9,081	
42 43 0	0 3 20	Port Vieux d'Estaubé	? 2901	9,518	
42 44 0	0 2 0	Brèche d'Allauz, F.	2516	8,255	From Cirque de Gavarnie to Estaubé.
42 44 0	0 8 0	Pic des Aiguillons ou Méchant	2969	9,748	C. P.
42 44 30	0 8 0	Col des Aiguillons, F.	2752	9,018	C. P. From Aragnouet to Héas.
42 47 30	0 8 0	Mont Cambiel, F. .	3173	10,410	
42 48 0	0 8 0	Col de Cambiel, F. .	2595	8,514	From Aragnouet to Gèdres.
42 48 30	0 7 0	Pic Long, F. .	3195	10,483	
42 50 0	0 7 0	Neouvielle, F. .	3092	10,145	
42 48 30	0 9 0	Pic Badet, F. .	3163	10,378	
42 57 0	0 10 0	Pic du Midi de Bi- gorre, F.	2877	9,439	
42 51 0	0 9 0	Col d'Aure, F. .	2500	8,202	Barèges to Aragnouet in Valley d'Aure.
42 43 30	0 9 0	Port Vieux .	2600	8,531	From Aragnouet to Bielsa.
42 43 0	0 11 0	Port de Bielsa .	2465	8,087	From Aragnouet to Bielsa.
42 43 0	0 14 0	Port de Moudang .	2487	8,159	From Valley d'Aure to Bielsa.
42 45 0	0 18 0	Pic Aret, F. .	2940	9,646	
42 42 0	0 18 0	Col d'Ordisset. .	2800	9,187	Tramesaigues to Bielsa.
42 42 0	0 19 0	Port de Plan .	2457	8,061	Vielle Aure to Plan, Val de Gistain.
42 44 0	0 24 0	Port de la Pez .	2466	8,090	Val de Louron to Val de Gistain.
42 43 0	0 26 0	Port de Clarabide .	2619	8,592	Val de Louron, Arreau ; to Val d'Essera, Venasque.
42 43 0	0 26 30	Pic de Clarabide .	2935	9,627	
42 43 0	0 27 0	Port de Benasqué .	2629	8,625	Val de Louron, Arreau ; to Val d'Essera, Venasque.
42 37 0	0 25 0	Pic des Posets, S. .	3367	11,047	
42 42 0	0 28 30	Pic du Port d'Oo .	3150	10,335	

Latitude N.	Longitude E. of Greenwich.	Peak or Pass.	Mètres.	Feet.	Where situate.
<u>42</u> <u>42</u> 0	0 <u>29</u> 0	Port d'Oo . . .	3001	<u>9,816</u>	Lac d'Oo to Val d'Essera, Venasque.
<u>42</u> <u>43</u> 0	0 <u>30</u> 0	Tus de Montarqué, F.	2983	<u>9,786</u>	
<u>42</u> <u>42</u> 0	0 <u>31</u> 0	Portillon d'Oo . .	3044	<u>9,987</u>	Lac d'Oo to Val d'Essera, Venasque.
<u>42</u> <u>43</u> <u>30</u>	0 <u>28</u> <u>30</u>	Crête de Spijoles, F.	3049	<u>10,003</u>	
<u>42</u> <u>45</u> 0	0 <u>28</u> 0	Pic Néré, South, F..	2840	<u>9,318</u>	
<u>42</u> <u>41</u> <u>30</u>	0 <u>32</u> 0	Perdiguères . . .	3220	<u>10,564</u>	
<u>42</u> <u>42</u> 0	0 <u>32</u> 0	Col du Quairat . .	3002	<u>9,850</u>	Lac d'Oo to Val de Litay- roles, Venasque.
<u>42</u> <u>44</u> <u>30</u>	0 <u>31</u> 0	Montaroye . . .	2803	<u>9,197</u>	
<u>42</u> <u>43</u> 0	0 <u>31</u> <u>30</u>	Pic Quairat, South, F.	3059	<u>10,036</u>	
<u>42</u> <u>42</u> <u>30</u>	0 <u>32</u> <u>30</u>	Pic de Crabioules	3219	<u>10,560</u>	
<u>42</u> <u>42</u> <u>30</u>	0 <u>32</u> <u>40</u>	Pic Intermédiaire .	3104	<u>10,184</u>	
<u>42</u> <u>42</u> 0	0 <u>32</u> <u>50</u>	Col de Crabioules .	3018	<u>9,900</u>	Val de Litayroles to Val de Lys, Luchon.
<u>42</u> <u>42</u> 0	0 <u>33</u> <u>10</u>	Tus de Maupas . .	3110	<u>10,203</u>	
<u>42</u> <u>42</u> 0	0 <u>34</u> 0	Pic de Boum . . .	3060	<u>10,039</u>	
<u>42</u> <u>42</u> 0	0 <u>35</u> <u>30</u>	Port Vieux . . .	? 2678	? <u>8,785</u>	Val de Lys to Val d'Es- sera, Venasque.
<u>42</u> <u>42</u> 0	0 <u>38</u> 0	Pic de Sauvegarde .	2786	<u>9,139</u>	
<u>42</u> <u>42</u> 0	0 <u>38</u> <u>30</u>	Port de Venasque .	2417	<u>7,930</u>	Hospice de Luchon to Venasque.
<u>42</u> <u>42</u> 0	0 <u>39</u> 0	Pic de la Mine . .	2767	<u>9,076</u>	
<u>42</u> <u>39</u> 0	0 <u>38</u> 0	Pic Albe, S. . . .	3280	<u>10,761</u>	
<u>42</u> <u>38</u> <u>30</u>	0 <u>39</u> 0	Pic de Maladetta, S.	3312	<u>10,866</u>	
<u>42</u> <u>38</u> 0	0 <u>39</u> <u>40</u>	Pic de Milieu, S. .	3354	<u>11,044</u>	
<u>42</u> <u>37</u> 0	0 <u>40</u> <u>30</u>	Pic de Nethou, S. .	3404	<u>11,168</u>	
<u>42</u> <u>39</u> 0	0 <u>43</u> 0	Pic Fourcanade, S. .	2882	<u>9,454</u>	
<u>42</u> <u>41</u> <u>30</u>	0 <u>40</u> <u>30</u>	Port de la Picade, S.	2424	<u>7,958</u>	Val d'Essera, Venasque, to Val d'Artigues de Lin.
<u>42</u> <u>37</u> 0	0 <u>47</u> 0	Port de Viella, S. .	2506	<u>8,222</u>	Viella to Castaneza.
<u>42</u> <u>51</u> 0	0 <u>51</u> 0	Port Rouge	2464	<u>8,084</u>	Valley de Castillon to Val d'Arran.
<u>42</u> <u>50</u> 0	0 <u>54</u> 0	Port de la Rouquette	2545	<u>8,350</u>	Valley de Castillon to Val d'Arran.
<u>42</u> <u>49</u> 0	0 <u>56</u> 0	Pic de Mauberne . .	2880	<u>9,449</u>	
<u>42</u> <u>36</u> 0	1 1 0	Col de la Ratière .	? 2600	<u>8,531</u>	Viella to Valley de la Noguera.
<u>42</u> <u>48</u> 0	0 <u>59</u> 0	Porte d'Orle . . .	2631	<u>8,564</u>	Valley de Castillon to source of la Noguera.
<u>42</u> <u>48</u> 0	1 3 0	Montvallier	2840	<u>9,318</u>	

Latitude N.	Longitude E. of Greenwich	Peak or Pass.	Mètres.	Feet.	Where situate.
0° 42' 41" 0	1° 10' 0"	Monts des Cuns .	2865	9,400	
42 42 0	1 14 0	Mont Collat .	2844	9,331	
42 40 0	1 23 0	Montcalm .	3080	10,105	
42 39 0	1 24 0	Pic d'Estats .	3141	10,305	(Chausenque.)
42 39 0	1 32 0	Pic de Siguier .	2901	9,518	
42 39 0	1 33 0	Port de Siguier .	2599	8,234	Vicdessos to Andorre; Val de Rialp.
42 39 0	1 35 0	Mont Rialp .	2747	9,012	
42 38 0	1 38 0	Port de les Cabannes	?2680	8,793	Les Cabannes to Andorre; Val de Rialp.
42 38 0	1 40 0	Pic Serrère .	2911	9,551	
42 38 0	1 46 0	Port de Fontargente	?2460	8,071	Ax to the Val d'Andorre; Les Caldas.
42 34 0	1 45 0	Port de Saldeu .	2500	8,202	Ax to the Val d'Andorre.
42 30 0	1 45 0	Port de Morrey .	2556	8,386	Hospitalet to the Val d'Andorre.
42 34 0	1 54 0	Pic Carlitte, F. .	2921	9,584	
42 37 0	1 56 0	Pic Peyric, F. .	2810	9,219	
42 25 0	2 7 0	Pic de Puigmal .	2909	9,544	
42 26 0	2 9 0	Col de Llo .	2550	8,366	From Fontpedrouse to Ribas.
42 28 0	2 16 0	Pic de Jéganne .	2881	9,452	
42 31 0	2 27 0	Canigou, F. .	2785	9,144	

THE END.

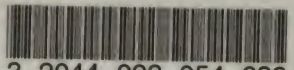
LONDON

PRINTED BY SPOTTISWOODE AND CO.

NEW-STREET SQUARE



3 2044 093 054 633



3 2044 093 054 633